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THE PHILOSOPHICAL REVIEW.

MECHANISM, FROM THE STANDPOINT OF PHYSICAL SCIENCE.[1]

THROUGHOUT the modern period science has, upon the whole, moved toward mechanistic interpretations, theories, and conceptions of the forms and functions of living things. Even in the seventeenth century Harvey's great work, the reflections of Galileo and Descartes, and such applications of the new science as Borelli's, brought forth a mechanical physiology. At the end of the eighteenth century Lavoisier, and a little later Saussure, found the true path of chemical physiology; while Lavoisier and Laplace in collaboration founded thermal physiology.

During the nineteenth century every department of physical science has been tested and found useful in the study of organic phenomena, and at length we have won a certain measure of success in describing 'living matter' as a physico-chemical system.

Meantime this movement, though often checked by great and possibly insuperable obstacles, has never been reversed. The

[1] The papers which appear as articles in this number of the Review form the contributions of the five leaders to the Discussion which has been arranged for the next meeting of the American Philosophical Association, to be held at Harvard University on December 27 and 28, 1918. The papers as here published have grown out of a preliminary meeting and conference of the writers. At this meeting a "Basis of Reference" was drawn up to serve as a common background for the separate papers. This has been already published in the *Journal of Philosophy, Psychology, and Scientific Methods*, Vol. XV, No. 17 (Aug. 15, 1918), and is reprinted among the 'Notes' at the end of this number.—Ed.

facts about living things, so far as relevant to physical science, whenever they can be brought into relation with the facts and theories of physical science, have always been found consistent with physical science. Such at least is the opinion of the overwhelming majority of qualified judges.

But this is not the whole story. Both form and function of the organism possess a pattern, and patterns are not often studied by the physical sciences, or at any rate by the abstract physical sciences which we are in the habit of thinking the foundation of orthodox mechanistic philosophy. It is true that Kepler proved that the solar system has a pattern, that Newton explained this as a special case of something which depends upon simple mechanical principles, and that later astromoners have found other examples which obey the same laws. It is true that there is no reason to suppose that all other patterns in space and time may not be explained in like manner. But yet it is certain that the pattern of organization has not been thus explained.

The best available explanation of the pattern of organization is natural selection. But natural selection is at present not stated in mechanistic terms, and, until the logical aspects of this question have been more carefully examined, it must remain doubtful what is to be said about the place of the struggle for existence and the survival of the fittest as physico-chemical processes. Moreover, the measure of the importance of natural selection in organic evolution is in doubt.

Thus the fact of organization remains a cause of both bewilderment and uncertainty among those who study the philosophy and theory of biology. Sometimes this difficulty is magnified because successful investigators remain oblivious to the problem itself; for it is not necessary even to face such questions when working experimentally upon particular questions of biological physics or biological chemistry, and what is unnecessary in successful work may be forgotten in the analysis upon which a synthesis depends. Moreover, the general views of men of science are likely to be naïve because they are sometimes merely the reflections of trustworthy habits of work. This was especially true during the last quarter of last century.

It is for such reasons as these that the controversy between mechanists and vitalists has lately been restricted to the field of organization, and here, disregarding questions of psychology which I do not feel competent to discuss, I shall examine it.

In the first place it should be noted that two anti-mechanistic theories are at present in the field. The one, as held by J. S. Haldane, insists upon the phenomenon of organization as something which belongs to a higher level than physical science, which involves categories that do not belong to physical science, and which in some way annihilates the physico-chemical description upon which, nevertheless, it seems to rest. At certain points this theory is related to the opinions of Claude Bernard and of still earlier French biologists.

The other theory is vitalism proper, and may be represented by the views of H. Driesch. According to Driesch the activities of the organism often involve, at critical moments, the operation of a directing agent or entelechy which is above the physical forces in that it is able, for instance, to suspend the operation of the second law of thermodynamics.

Taking up first the neo-vitalism of Driesch and his allies, I know of no answer that can be made to it but one: The proof that mechanism is not enough to describe and explain certain organic phenomena, such as that which has been set forth by Driesch himself, is not of the character of scientific proof. In the very nature of the case it concerns phenomena which are but little understood, and accordingly it never seems to come to grips with the question. Try as I may, I have not been able to see in Driesch's proof of vitalism more than an interesting and valuable, but overconfident, discussion of obscure subjects.

It is customary to oppose Driesch's arguments with the induction in favor of the second law or the other most general principles of physics, and it is truly said that nearly the whole of physical science contributes to the induction. Nearly, indeed, but not quite the whole. For there still remain uncertainties about the second law which were known to such men as Willard Gibbs, Clerk Maxwell, and Boltzmann; and, as a rule, the best physicists are rather more cautious about claims of exhaustive and rigorous proof than are either mechanists or vitalists among the biologists.

Clerk Maxwell long ago pointed out another difficulty which confronts those who try to meet Driesch specifically. There is an important class of physical phenomena which are habitually avoided by the physicists, and which involve great difficulties for the determinist. These include processes which possess singularities of many kinds, such as the right word at the right time, or, turning to physical phenomena, certain types of catalytic processes. Similar ideas have been presented by Boussinesq and by Charles Peirce. Now it is upon phenomena such as these, doubly obscure because hidden within the living cell, that Driesch founds his case. His opponent is therefore somewhat put to it to stretch the induction of the second law so as to include these critical cases. Most of us feel confident that the second law will hold, but if we claim too much we shall be putting opinion in place of certainty, just as we think Driesch does. And so, for my part, I can only come back to the conviction that Driesch is talking too confidently about things that none of us understand, and that, so far as I can judge, the weight of the evidence is greatly against him. For the well known types of physical phenomena this seems to be established. There is room for a difference of opinion only in certain obscure cases. But there can be no doubt, as Clerk Maxwell long ago said, that such cases are of peculiar importance in the organic world.

The anti-mechanistic opinions of Haldane are of quite a different character. For Driesch the miracle of organization is such that it can exist only by virtue of certain agencies which do not belong to the world of physics and chemistry. For Haldane, who is a thorough-going idealistic metaphysician when not experimenting in the laboratory, physics and chemistry are but imperfect stepping stones to knowledge, and cannot be in question when the miracle of organization is before our eyes. This opinion of an eminent experimental physiologist has proved disconcerting to some of his colleagues, and has been generally misunderstood.

In the first place, as Haldane says, it is not the physical and chemical phenomena, but the organization of them, with which the biologist, as such, is concerned. He must indeed know the

physical and chemical phenomena so as to be able to see their organization. But it is this pattern of organization which is the really biological phenomenon. In short, a knowledge of the pattern of organization of chemical and physical phenomena in space and time leads us on to reality. And then, if I too have not misunderstood Haldane's view, somehow we have only the pattern; time, space, molecules and calories have disappeared.

I can only leave the metaphysical portion of this doctrine to the metaphysicians. For the rest, it seems to me plain that organization is a necessary biological category, that it is not involved in abstract physical science, and that mechanism (as now understood) leaves it out.

If this is true, two questions arise. The first is whether a straightforward description of organization should be regarded as a mechanistic description. Here, as I believe, we are concerned only with a matter of definition, complicated by the fact that physiologists have not yet made great progress in the study of organization, as distinguished from the phenomena which are organized. But, in spite of Haldane's conviction that it is impossible to conceive organization in physical and chemical terms, this seems by no means impossible to most physiologists, and many are plainly making progress in this direction.

Moreover, all the characteristics of the organization of living things are not peculiar to such organisms. Thus it is generally admitted that to speak of the organization of society is more than a figure of speech, and the justification of this view is found in the similarity of regulatory processes and of the conditions of stability in the two instances. It is true that each type of organization has its distinctive characteristics, but in large measure these depend upon the nature of the materials organized.

Another example of organization, no less conspicuous when closely examined, is the meteorological cycle. Here again it is the regulatory processes and the conditions of stability which reveal the true nature of the case.

In short, organization, while peculiarly a biological category, is by no means restricted to the field of biology. It is not, to be sure, involved in the abstract physical sciences, but whenever

particular systems are in question, in meteorology and in sociology as well as in biology, organization is in question. Indeed I can see no objection to speaking of the organization of the solar system. The idea behind these views is as old as Lucretius.

Accordingly, it seems not unreasonable to hold the opinion that the fact of organization is insufficient to overthrow the mechanistic hypothesis, although it must be admitted that a mechanistic philosophy which leaves organization out is meaningless. For the world is made up of nothing but individual systems, in which we find matter and energy, and sometimes organization.

Finally, Haldane's analysis naturally leads to another question. What is the origin of organization? Is it natural selection, or speaking more generally so as to include the thought of Hume and of Lucretius, is it the fact that stable systems survive, and that some kinds of stability involve that which, in the organism, we call regulatory processes?

I cannot answer this question, and I am suspicious of all attempts to answer it. For no one knows whether life has always existed in the universe, or, if not, by what process it first appeared.

Admitting the alternative more favorable to vitalism, we may say that conceivably the pattern of the living organism is not merely the result of a mechanistic process, but that the primitive elements of it may have always existed. This would distinguish it from the organization of the meteorological cycle or of society, and seriously undermine the mechanistic hypothesis.

But, because I seem to see a pattern in the properties of the chemical elements which is, so to speak, predetermined rather than a product of adaptation, and because this pattern involves the very difficulties which are raised by the hypothesis that life has always existed, this last objection falls away.

Therefore, with the qualification that science is far from omniscient, and the reservation that I cannot pretend to judge the problems of psychology, I accept the mechanistic hypothesis as, upon the whole, most consistent with the evidence.

LAWRENCE J. HENDERSON.

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MECHANISM AND VITALISM.

IF science had only living things as objects of study, beyond doubt it would now present itself under a very different aspect from that which it has received from the study of the non-living. Fundamental and all-inclusive doctrines, such as radical mechanism, have sprung historically from physical science, not from biology. Biological science is in but an embryonic condition as compared even with physical science. Would full analysis of the phenomena presented by the living yield a body of doctrine of the same kind that the study of the non-living gives us? In what respects would a science based primarily on the living differ from that based on the non-living? Would the final elements reached by analysis be the same in the two cases? Would the laws of change be the same?

The relatively incomplete formulations given by biological science would yield, taken by themselves, only fragments of the various kinds of scientific description set forth as existent in the formulation adopted as a basis of reference in this discussion.[1] Therefore, our examination of the questions just proposed will center chiefly about the underlying relations in the perceptual phenomena which make scientific formulation possible.

The fundamental characteristics of phenomena that in the non-living have given rise to the existing formulations of science appear to be as follows:

1. When studied by the method of experimentation (including inference from the results of experiment, with further experimental test of these inferences), the phenomena have shown such continuities in space and time that diversities in any given characteristic (save those of space and time) are accompanied by diversities in other characteristics. Thus alteration of one characteristic changes others, as when according to the law of gravi-

[1] R. F. A. Hoernlé, "American Philosophical Association; Preliminary Meeting of Leaders of the Discussion on Mechanism versus Vitalism." *J. of Ph., Psy. and Sci. Meth.*, XV, pp. 458–467 (see also pages 672, 673 of this number of the REVIEW).

tation, altering the distance between two bodies likewise alters the attraction between them.

Practically important is the temporal manifestation of these interconnections, in that later perceptual diversities in a system are always preceded by earlier perceptual diversities, which are found experimentally to determine the later ones (in the sense that if the earlier diversities are removed, the later ones disappear). The prevalence of this condition of affairs we call experimental determinism. We may sum up in the statement that *the formulation of inorganic science is a result of the prevalence throughout it of experimental determinism.*

2. The number of *effective* diversities is smaller than the number of separate phenomena distinguishable in space and time, so that there are common features in the distinguishable phenomena, and common results from the common features.

3. The determining diversities and their experimental consequences fall into an orderly system. Types of such partial systems are the three laws of motion; or within these, the laws of the parallelogram of forces. The entire orderly system resulting from experimental determinism constitutes inorganic science.

Does the science of the living show these characteristics? And to what extent is the system it yields like, or diverse from, that of inorganic science?

The various answers proposed for these questions are the theories of vitalism and of mechanism. Many diverse doctrines are held as vitalism, with a correlative number of opposed doctrines often designated as mechanism. Some of these doctrines relate to the general characteristics that have made scientific formulation possible; others to the contents of the formulated science. The diverse vitalistic theories may be grouped in three classes. One class criticizes the adequacy of experimental formulation for the phenomena of life. A second, accepting such formulation, maintains that when applied to the living it yields elements and laws diverse from those reached by the study of the non-living. The third class holds that life reveals the characteristics of the universe more directly than does the non-living, so that biology is more fundamental than physics.

We shall take up in succession these three classes of theories, asking: What would be the experimental situation if the given doctrine were correct?

I. Doctrines that Criticize the Adequacy of Experimental Formulation for the Phenomena of Life.

Many vitalistic theories hold that the perceptual determiners of events,—those discoverable experimentally—are not 'adequate' to the results produced, at least in living things; that they cannot 'account for' what happens; they do not make it intelligible that the observed phenomena should appear.

It is clearly true that the experimental results produced under many perceptual conditions are to be learned in the first instance only by experience, and are not to be deduced from a previous analytical consideration of those perceptual conditions alone; in this sense the perceptual conditions are not adequate and do not make the results intelligible. Thus Neal argues that "the formula of mechanism" (which he identifies with experimental determinism) is not "adequate to experience."[1] That this is correct in the sense just set forth is I believe generally recognized.

What follows from this? Three different sets of attitudes are taken by diverse thinkers. (1) One set admits that ultimate intelligibility in the sense of the deducibility of all occurrences from something else is not found. The final elements of knowledge—the phenomena and the interconnections of phenomena—are simply observed, not deduced nor 'understood'; their number and nature can be learned only by experience. Intelligibility arises from the observed fact that the interconnections of phenomena, the correspondence of diversities, fall into an orderly system. To seek it anterior to or independent of these orderly interconnections is to seek it outside of that which constitutes it. This is equally true in the living and in the non-living. The work of science is merely to discover the elements and to formulate their interconnections.

A second attitude holds that since the perceptual conditions

[1] H. V. Neal, "The Basis of Individuality in Organisms; A Defense of Vitalism," *Science*, XLIV, pp. 82–97.

do not give an adequate account of the resulting phenomena, it is necessary to assume in addition some non-perceptual agent which does. So, Neal maintains that "individuality (personality) is a phenomenon not determined by the perceptual conditions only, but requiring to account for it the agency of a non-perceptual agent."[1]

Assuming the legitimacy of the demand for this type of intelligibility, the logical conclusion appears to be that the non-perceptual agent occurs *in addition to* the perceptual conditions; there seems here no ground for rejecting the experimental determiners, but only for supplementing them. This attitude is taken more or less vaguely by many. The perceptual things, the things that we see, it is held, are merely the garments of something non-perceptual; they are only signs by which are revealed the spiritual; they "weave God the garment thou seest him by." But these spiritual agents never act without a clothing of the perceptual, by which they may be detected. Thus we can use the perceptual in all our scientific work; it never fails to reveal to us the presence of the underlying spiritual realities.

It is obvious that such a doctrine leaves quite untouched that experimental determinism on which scientific formulation depends. The most convinced experimentalist can hold it without the slightest weakening of confidence in his methods of work. One finds in scientific literature little expression of such views, because obviously the matter has nothing to do with science; but conversation shows that there are many men of science that hold, in a more or less indefinite way, doctrines of this character. It is, I believe, under a hazy impression that the doctrines of Driesch are of this sort that many incline toward such a concept as entelechy. A thinker of high standing informs me that, although he rejects the experimental indeterminism of Driesch, he inclines to accept the remainder of the doctrine of entelechy; this may be typical.

Whatever the satisfaction such beliefs give to other instincts, they obviously do not satisfy that need which leads to the scientific analysis of complex phenomena. This need is based on the

[1] *Ibid*

complexities; transferring these to a non-perceptual agent, as Driesch transfers the complexities of development to entelechy, leaves them in exactly the same need of analysis and explanation as before. Such doctrines therefore can play no part in the work of science.

The third attitude toward the inadequacy of experimental formulation is the result of this scientific impotency of the non-perceptual agent conceived merely as added to the perceptual determiner; such ineffectual ghosts do not attract serious interest. This third view makes the non-perceptual agent play a really differential part; makes it take the place of missing perceptual determiners. It holds that from the same perceptual conditions in different instances diverse perceptual results may flow, depending upon the differential activity of non-perceptual agents, so that the experimenter is bound to find situations in which no perceptual determiners exist for perceptual diversities of result. It rejects experimental determinism (although it may cling to 'absolute determinism,' since the non-perceptual agent is held to determine the result).

I find reluctance on the part of some men of science to believe that there exist doctrines that are confessedly of this character. Yet the doctrines of vitalism that are now most influential are of precisely this kind; the non-perceptual agent must play a part that affects scientific formulation or men of science give it no attention. The vitalism of Driesch, doubtless that most discussed (though in its essence little known), is consciously of this third type; a full grasp of his complex system will show clearly that it is based on experimental indeterminism. As doubt has been expressed of this, it may be best not to leave the assertion to a sustained study which few will make. The question was put squarely to Driesch by both parties to a dispute on the matter, and as squarely answered. Driesch says: "I reject absolute indeterminism, but *accept* experimental indeterminism. . . . Two systems absolutely identical in every physico-chemical respect may behave differently under absolutely identical conditions, in case that the systems are living systems."[1]

[1] See fuller quotations and discussion of this matter in the following papers: H. S. Jennings, "Driesch's Vitalism and Experimental Indeterminism," *Science*,

Many writers have expressed sympathy with the doctrine of Driesch, though whether they realize it to mean experimental indeterminism is not always clear. But Johnstone[1] presents the same sort of theory, consciously following Driesch. Neal[2] defends the same point of view, explicitly including the experimental indeterminism. Bergson[3] as is well known, expressly holds to indeterminism in the living.

The commoner forms of vitalism indeed, though often but vaguely worked out, will be found to assume the production by a single agent of various diverse activities. The favored procedure is the selection, among various courses of action assumed to be possible under given perceptual conditions, of sometimes one course, sometimes another, depending upon the end to be reached. This is of course precisely experimental indeterminism, ineffectually concealed by the common practice of calling this agent by the conciliatory name of 'vital force.'

This type of vitalism has direct bearing upon scientific work; if perceptual determiners for diversities of occurrence do not exist, it is idle to search for them. To the extent that this doctrine is correct the experimental method fails in biology. I therefore propose to examine certain points as to the foundation for this doctrine, referring to my previous papers for discussion of others.

This type of vitalism (as indeed most others) is based mainly on those relations between phenomena that are characterized as teleological; upon adaptive activities and structures.

It must be questioned whether the teleological represents anything diverse in principle from what is given in ordinary scientific descriptions even of the inorganic; whether teleological description is anything more than a 'short-cut' for expressing in brief what could be expressed with equal accuracy in terms

XXXVI, pp. 434, 435; "Doctrines held as Vitalism," *American Naturalist*, XLVII, pp. 385–417; A. O. Lovejoy, "The Meaning of Driesch and the Meaning of Vitalism," *Science*, XXXVI, pp. 672–675; see also H. Driesch, "Ueber die Bestimmtheit und Voraussagbarkeit des Naturwerdens," *Logos*, IV, pp. 62–84.

[1] J. Johnstone, *The Philosophy of Biology*, Cambridge, 1914.

[2] H. V. Neal, "The Basis of Individuality in Organisms; A Defense of Vitalism," *Science*, XLIV, pp. 82–97.

[3] H. Bergson, *Creative Evolution*, New York, 1911.

that would not suggest purpose, but would require more words (and this because language has been built up largely on the basis of human purpose). Among the matters to be described and accounted for are the relative *durabilities* of phenomena. In an investigation of such matters, one would inquire how it happens that a piece of granite is more lasting than a piece of ice; how it happens that certain products of chemical reaction are evanescent while others endure; how it happens that some whirlpools last while others quickly vanish; that some river systems endure while others have disappeared; how it happens that certain processes (*e. g.*, the disintegration of radium) continue, while others are interrupted,—and so would pass without any logical break to the study of how it happens that the systems called living persist as they do (while many of them do *not* persist). In all cases one would find relations between the parts of the systems, on which the durability depends. In the more complex systems (rivers, solar systems, organisms) one would find relations between complex components tending to the maintenance of the system or of its component phenomena. To apply the same terms to these relations that we apply to the conscious purposes of human beings is justifiable only on the ground that these conscious purposes likewise tend to the maintenance of certain phenomena; but it should be done equally for those characteristics of the inorganic that show similar relations, as has recently been done on a large scale by Henderson.[1]

Organisms are complex cyclical systems, a similar train of successive phenomena being repeated in each cycle that constitutes the total life of an individual. In such systems adaptive relations show themselves between phenomena separated in time, and *if we limit consideration to a single cycle* or individual life, as is commonly done, an earlier phenomenon shows evident

[1] L. J. Henderson, *The Fitness of the Environment*, New York, 1913. The conception of the teleological as a matter of durability has been developed by many, notably by W. Roux, (*Der Kampf der Theile im Organismus*, Leipzig, 1881) who was perhaps the first to so interpret it; by P. Jensen (*Organische Zweckmässigkeit, Entwicklung und Vererbung vom Standpunkte der Physiologie*, Jena, 1907); and recently in a valuable paper by R. Lillie ("What is Purposive and Intelligent Behavior from the Physiological Point of View", *J. of Ph., Psy., and Sci. Meth.*, XII, pp. 589–610) who deals with it as the maintenance of equilibrium.

relations to one not appearing till later in that particular cycle, as when the lens of the eye develops in the dark. It is mainly these relations to the future that have raised the problem of teleology.

This problem does not arise from the nature of the single acts involved in adaptive processes; it will be admitted that each of these taken by itself would present no obstacles to perceptual determinism. If shots are made in all directions, some will go toward a particular mark; for those that do so no special explanation, no effect of the mark on the direction of the shots, is required. It is only when the others are omitted and all go toward the mark that the question arises whether the mark is influencing the direction of the shots. Eyes do not now develop in every conceivable way, only one in ten million producing a structure resembling a lens; if this were true, no one would feel that this single case required a teleological explanation. The problem of teleology in complex systems is based on a statistical situation; certain operations tend more uniformly toward a particular mark than appears to be accounted for by determination independent of the mark; and when the 'mark' does not exist (*in the particular cycle under consideration*) until later, the problem takes on its most characteristic form.

Does such a situation exclude experimental determinism? On the contrary, a general method is known by which experimental determinism results in this situation; the knowledge is now a common possession of mankind. It is the method of automatic persistence of one type of activities, or of one configuration, out of many produced or begun. The method is exemplified throughout nature; particularly in physical chemistry, with its study of equilibria and of rates of reaction. In living things it is known that such action takes place on a grand scale. In an extremely gross form we are familiar with it as natural selection. In another we see it, as the formation of habits, producing adaptive actions within the compass of a single individual cycle; out of movements that are at first varied, some become fixed.

In sum, we find throughout nature a method fully intelligible

as perceptually determined in every step, by which a set of acts becomes directed toward an end. The occurrence of such adaptive action is therefore not evidence against perceptual determinism, but results precisely from its operation.

Turning to certain concrete fields, the case for the vitalism that rejects experimental determinism rests largely upon arguments from the development of organisms, as elaborated by Driesch. I believe that it may be correctly said that the advance of knowledge in this field has destroyed the factual basis of Driesch's argument. In an earlier paper[1] I attempted to summarize these advances in their bearing on the problems now under discussion. Space does not permit setting forth the concrete facts here, but certain general relations may be touched upon. Driesch's argument is based fundamentally upon the development and regeneration of what he calls "harmonic equipotential systems"; the eggs and bodies of many organisms are characterized as such. The basis for this concept is the fact that various parts of the egg or organism can produce an entire organism, or other parts than those which they usually produce. Hence it is concluded that all the elements of the developing organism are potentially the same; that any part can produce any part ("*Jedes kann jedes*") that the fate of a part depends upon its position; that the system is "*equipotential.*" From this it is argued that development cannot be determined by any "typical configuration of physical and chemical elements," such as might be called a machine, although perceptually it could not be determined in any other way. It follows therefore that it is not perceptually determined; a non-perceptual determiner—entelechy—must be called in to account for the results.

From this line of argument it might readily be supposed that all parts of such germs are actually potentially equivalent, in the sense that one could be substituted for the other. This would amount to a complete lack of *effectively* diverse parts in the germ, leaving indeed the problem of the method of development into the complex animal in a desperate situation. Such a

[1] "Development and Inheritance in Relation to the Constitution of the Germ," *Johns Hopkins University Circular*, December, 1914, pp. 21–72.

conclusion has indeed been drawn even by men expert in biology; von Uexküll for example asserts that "Driesch succeeded in proving that the germ cell does not possess a trace of machine-like structure," and that "the organization of a structureless germ into a complicated structure is a power *sui generis*," etc.[1]

It appears probable that such a notion is widespread among men not familiar with the facts at first hand.

As a matter of fact, *no such thing as an equipotential system exists* among organisms, if the phrase be taken in any literal sense. Driesch himself remarks that it is only "an approximate, as it were, figurative, method of speech."[2] The "elements" of the germ which are asserted to be potentially alike are in fact each complex systems, in which the parts are by no means effectively or potentially equivalent. Each such "element" contains a visible complex apparatus, known as the chromosomal apparatus. The recent study of genetics has shown that this apparatus is the system on which the peculiarities of development mainly depend. This system is not equipotential; the fate of its parts is not a function of their position; it has a complex structure with a corresponding complexity of action; altering any of its parts alters correspondingly the action of the system; irregular removal or disarrangement of the parts destroys the action. This apparatus visibly interacts throughout development with the less differentiated cytoplasm, visibly producing developmental differentiations. Nothing could be conceived that would furnish a better basis for an experimentally determined and experimentally intelligible course of development.

Now, organisms are peculiar in that each small part of the body contains such an apparatus complete. No part of the body or germ that does not contain such a system will develop. But each part that does contain such a system is capable of developing into an entire body or into any part of the body,—*provided the proper other conditions are supplied*. But this proviso limits the realizable possibilities in a high degree. The nature of many of the necessary other conditions is slowly becoming known, and

[1] "Die Neuen Fragen in der Experimentellen Biologie," *Rivista di Scienza*, "Scientia," IV.

[2] *Naturbegriffe und Natururteile*, p. 181.

the whole furnishes the outline of a natural, experimentally intelligible scheme of operation.

It is extraordinary how precisely the distribution and operation of this apparatus fulfills the conditions set forth by Driesch as a basis for his assertion that no material system ("machine") can underlie development. After setting forth that a machine "might very well be the motive force of organogenesis in general, if only normal, that is to say, if only undisturbed development existed, and if a taking away of parts of our system led to fragmental development," he points out that "there may be a whole development out of each portion of the system, above certain limits, which is, say, of the Volume V. Good! Then there ought to exist a machine, like that which exists in the whole undisturbed system, in this portion V also, only of smaller dimensions; but it also *ought* to exist in the portion V_1, which is equal to V in amount, and also in V_2, in V_3, V_4 and so on. Indeed, there do exist almost indefinitely many Vn, all of which can perform the whole morphogenesis, and all of which therefore *ought* to possess the machine. But these different portions V_n are only partially different from each other in spatial relation. Many parts of V_2 are also parts of V_1 and of V_3 and of V_4 and so on; that is to say, the different volumes V_n overlap each other successively and in such a manner that each following one exceeds the preceding one by a very small amount only. But what then about our machines? Each volume which may perform morphogenesis completely must possess the machine in its totality. As now every element of one volume may play any possible elemental rôle in every other, it follows that each part of the whole harmonious system possesses any possible elemental part of the machine equally well, all parts of the system being at the same time constituents of different machines. A very strange sort of machine indeed which is the same in all its parts." Driesch therefore concludes that "therefore there can be neither any sort of a machine nor any sort of causality based upon constellation underlying the differentiation of harmonious equipotential systems."[1]

[1] The passages quoted are from Driesch, *The Science and Philosophy of the Organism*, Vol. 1, 1908, pages 139–141. The discussion is elucidated by a diagram.

Now, if we call the chromatic apparatus the 'machine,' this passage might almost be considered a statement of the observed facts concerning its distribution and action. If the pieces are cut so as to contain one or more of the complete 'machines,' and the other necessary conditions are supplied, each will produce an entire organism. If a piece is left without a 'machine,' or with only an imperfect one, it will not develop.

How the 'machines' are activated and correlated; how development occurs, presents experimental problems in great number, but they are totally diverse in character from the riddle that an actually 'equipotential system' would put before us; they have no implications of experimental indeterminism.

After long standstill, in no field has knowledge of perceptual determination so increased in recent years as in that of development and inheritance; no field yields more full and minute testimony to the existence of perceptual determiners for all sorts of diversities of occurrence. No case can be cited in which perceptual diversities of result are without experimental determiners; in most cases it is easy even now to point these out. The picture of the phenomenal situation on which Driesch based his vitalism has in my opinion been completely superseded.

The condition of affairs just scheduled may be fairly said, I believe, to be typical for the progress of biological science. In chemical regulation and in behavior, which have likewise been exploited for the differential activity of a non-perceptual agent, knowledge is perhaps less adequate than in development. But continued investigation yields steady increase of knowledge of perceptual determination in both these fields. In behavior, the extraordinary complexity of the nervous system furnishes groundwork for a complete correspondence between antecedent perceptual conditions and later occurrences; and study of heredity and of environmental conditions in determining behavior adds evidence in the same direction. Nowhere does a bar to progress appear.

A special position with relation to this problem has often been given to the phenomena of 'conscious states,' which accompany behavior in some living things. On the existence and apparent

effectiveness of these are based the vitalistic doctrines known as psycho-vitalism. If, as may be urged with plausibility (though not demonstrated), these are peculiar to living things, then we have, *ipso facto*, a basis for a purely descriptive vitalism; something occurs in the living that does not occur in the non-living. Beyond this, the legitimate postulate of psycho-vitalism appears to be that diverse conscious states result in diverse actions. Experimental science, in my opinion, has no proper quarrel with this proposition. To the particular individual his 'conscious states' answer all tests for experimental determiners of his actions, and I see no ground for withholding from them this designation. The only ground on which this could be done would be the assumption that they are not, like other perceptual determiners, bound up with objective perceptual phenomena that act in turn as determiners of them. If diverse conscious states (for example, diverse purposes or diverse sensations) may occur and produce diverse actions when all other perceptual conditions are the same, then the 'conscious state' acts precisely as a non-perceptual determiner; and particularly does it play this rôle in the experimentation of an investigator who is not the particular self to whom these conscious states are proper. If the same organism with all objective perceptual conditions identical, may act sometimes in one way, sometimes in another, as determined by diversities of conscious state that are inaccessible to the experimenter, then in biology the investigator is indeed confronted with experimental indeterminism.

There is no experimental ground for the assumption that leads to this result. In all classes of 'conscious states' we know that diversities are experimentally producible by diversities in objective perceptual conditions. The farther investigation proceeds, the more extensive and precise becomes this correspondence. No case is established of a diversity in conscious states that is not experimentally determined by a diversity in objective perceptual conditions. To argue that such occurs is to employ ignorance as foundation for a positive doctrine. The assumed isolation of 'conscious states' is not based upon experimental analysis, but is opposed to it. Experimentally they bear to

other phenomena relations comparable to that between attraction and inertia (mass) as expressed by the law of gravitation; when one changes the other changes, so that each is a condition of the other. The experimental determination of other phenomena by diversities in conscious states, presents no difficulties to the investigator. Since with different conscious states (as with different inertias) there always go other diversities, to the outside investigator these other diversities serve as experimental determiners. That is, the diverse activities have as experimental conditions diverse antecedents both in 'conscious states' and in other phenomena, and the question as to which are the 'real' determiners has no experimental meaning. The situation does not differ from that presented by other phenomena, for the basis for experimentation lies in the fact that no one phenomenon changes without a change in another. It presents no foundation for the common gibe that those who accept it hold that all would occur exactly as it does without consciousness.[1] As well argue that all would occur as it does without gravitation or chemical action, or any other constituent phenomenon of the universe. The fact that these are bound up throughout with other perceptual conditions is no more an argument against their playing a part in the universe than it is against the effectiveness of consciousness. No experimental meaning can be given to the statement that the same conditions without consciousness would produce the same result; for the same conditions do not occur without consciousness.[2]

In all these most difficult fields, the history is one of steady progress in the discovery of experimental determiners, and this coupled with the fact that no cases are found which when fully examined lack experimental determiners, logically leads to the conclusion that there is no bar to the extension of this kind of knowledge in any direction and to any case whatever; that perceptual determiners will be found for any occurrence that is suffi-

[1] See Neal, "The Basis of Individuality in Organisms; a Defense of Vitalism"; *Science*, XLIV, pp. 82–97, for exploitation of this notion.

[2] This impotence of consciousness is a deduction, as will be brought out later, from the narrowest special doctrine of mechanism; thence it has been illegitimately transferred to experimental determinism by opponents of the latter.

ciently studied. The argument against experimental determinism is an argument from our ignorance; but an argument from ignorance is not strong when that ignorance decreases in proportion to the thoroughness of examination.

What is the bearing of the fact that the complex and variable phenomena which there is most tendency to ascribe to the operation of non-perceptual agents, or to consider quite undetermined, occur precisely in connection with the most complex, varied, and changeful perceptual conditions? If they occurred in connection with simple and uniform perceptual substrata, there might indeed be difficulty in supposing antecedent perceptual diversities for all diversities of occurrence. But the bewildering complexity and variety of occurrence in living things is fully met by a correspondingly bewildering complexity and variety of perceptual conditions; the latter set have no more been penetrated by the mind's eye than have the former. This complexity of perceptual conditions underlying the complex activities of life is inexplicable if diversities of action do not require diversities of perceptual conditions.[1] Moreover, the positive fact that the perceptual conditions underlying life are precisely such as would give rise to the sort of phenomena found in the living has been demonstrated at length by Henderson[2]. To account for these things the upholder of non-perceptual determination is logically driven toward some such desperate assertion as that made in pre-evolutionary times to account for the occurrence of fossil remains; they exist in order to test the tenacity of faith of those who cling to determination by non-perceptual agents. To reject the inexhaustible store of perceptual determiners in order to assume non-perceptual ones is to sin against the law of parsimony; it creates entities without need.

[1] See the development of this point by R. S. Lillie, "The Philosophy of Biology; Vitalism versus Mechanism," *Science*, XL, pp. 840–846.

[2] *The Fitness of the Environment.*

II. DOCTRINES WHICH HOLD THAT SCIENTIFIC FORMULATION APPLIED TO THE LIVING YIELDS ELEMENTS AND LAWS DIVERSE FROM THOSE REACHED BY STUDY OF THE NON-LIVING.

We have tried to show that the progress of science tends to establish the experimental determinism of all phenomena, living as well as non-living. *Such experimental determinism is independent of all doctrines that would require the elementary phenomena and laws to be the same in the living as in the non-living; that hold it theoretically possible to deduce or predict the phenomena of the living from those of the non-living; that would deduce all knowledge from one or a few principles or analyze all phenomena into one or a few elements.* It does not imply or oppose the 'autonomy' of different classes of phenomena. All it demands is a systematic correspondence of later perceptual diversities with preceding ones; what the later diversities shall be, need not be known till they occur. So far as it is concerned, when conditions or configurations not before examined or not before occurring are studied, entirely new phenomena may appear; and these in their turn beget other new ones. It does not demand this, nor does it forbid this. It demands only that if a new phenomenon appears, it shall be the result of a new combination of conditions, not of one that has previously occurred.

Biological science at its present stage can do little to establish or refute, with probability, these special doctrines. The investigations hitherto made do not rule out the occurrence in the living of types of phenomena that do not occur in the non-living. Many phenomena have been set forth as peculiar to the living; the production of but a single one of the two sorts of asymmetrical crystals[1]; the occurrence of objects combining "typical" form with changing physico-chemical constitution (Driesch); non-obedience to the second law of thermodynamics[2]; the occurrence of consciousness. Some of these are complex phenomena, the occurrence of which would not clearly involve new elements or

[1] See W. McPherson, "Asymmetric Syntheses and their Bearing on the Doctrine of Vitalism," *Science*, XLV, pp. 49–57; 76–81.

[2] H. Driesch, "Das Leben und der Zweite Energiesatz;" *Ann. d. Naturphilosophie*, VII, pp. 193–203.

laws. Others are uncertain as to their occurrence or distribution. The most plausible case for new elementary phenomena can be made out for consciousness, but it is not possible to prove that this is limited to the living; Haeckel for example holds it to occur throughout nature. In many cases these supposedly 'new' phenomena are set forth as indices of non-perceptual determining agents, but their occurrence appears to give no indication of experimental indeterminism. Nothing in the history of biological science negatives their occurrence in living things alone.

The most famous of the all-inclusive doctrines derived from inorganic science is mechanism (in the strict sense). A consideration of its relation to biology will best bring out the state of that science in respect to a number of disputed questions.

The essence of the doctrine of mechanism is something as follows: Many phenomena turn out on examination to be merely special cases of certain general relations between a restricted number of elements; general relations that are circumscribed and perspicuous, all following a single general law. For example, the resultant of two forces acting at an angle of thirty degrees may be examined, after resultants from other angles have been studied; the new case is found to be comprehended in the same law as the others. The relations of the elementary phenomena, —electrons, atoms, positions, motions, etc.,—appear to form a system of such limited variability as to be exhaustible by the mind. Distance alters in but two ways; mass in but two ways; angles of action only through the circumference of the circle; and so on, the possible relations being determinate in number and character. And so it appears to be possible to give a complete schema for all possible configurations and motions. All things in motion appear to find their precise places in this schema. To compute the future configurations and motions of any system it is required only to supply the quantitative data for any particular instant.

Mechanism in its more restricted form holds that all configurations and motions are thus determinate and computable. In a more inclusive form it may hold that all phenomena are nothing but such computable configurations and motions. In a

third and intermediate form it holds that any phenomena other than configurations and motions occur at specific and computable junctures of the configurations and motions, so that the laws of occurrence of all phenomena are statable in terms of those of configuration and motion.

What is the relation of biological science to this doctrine in its various forms?

At least some living things present the phenomena of 'conscious states.' There is practically complete agreement that these are not analyzable into 'nothing but' configurations and motions. Grant that they occur at certain configurations and motions, the 'conscious state' adds a distinctive element to these. If this be admitted, it is clear that mechanism in its more inclusive form is not correct for the living; they are not '*nothing but*' configuration and motion.

No one will deny that some conscious states are subject to experimental determination; a weight falling on the foot experimentally yields pain. Such instances show that *not all experimental determination is completely analyzable into the elements set forth by mechanism*; the *thing determined* at least is here something additional.

Does the lack of coincidence between experimental determination and mechanism go farther than this? May the next step in the process—the movement following the conscious state—likewise not coincide with that predictable from a mechanism that does not take into consideration the conscious state?

Here is the crux of the problem of mechanism. Are our actions and those of other living things computable from the system of mechanism, given a knowledge of the configurations and motions of the system preceding the occurrence of the state of consciousness?

Evidently if the schema of mechanism includes the nature of the motions under all possible configurations (which appears not theoretically difficult in consideration of the nature of the schema), then mechanism *can* theoretically predict just what I shall do, without consideration of the state of consciousness that occurs. This is the theoretical situation that results in making conscious-

ness a mere epiphenomenon. If actions can be computed and predicted without taking states of consciousness into consideration, then the latter are not differential determiners.

If on the other hand the conscious state is something that must be considered in the computation; if the computation carried out without it results in a false prediction; then at the occurrence of the conscious state the laws of motion of the particles must become altered. The electrons, the atoms, or other units, now move according to other laws,[1] and a diverse general result follows. If, for example, it is in the laws of composition and resolution of forces that the change comes, then the resultant of the various forces at work would be no longer computable from their number, dimensions, directions and relative angles of action according to the laws that prevailed before the state of consciousness occurred.

This would be strictly compatible with experimental determinism provided the configurations at which the different states of consciousness arose were diverse from those at which there was no consciousness; experimental determinism does not demand that the results of any particular configuration shall be known until it occurs. There is I believe nothing in the results of the investigation of the living that opposes this possibility.

To pursue the matter a step farther, if we assume mechanism for the non-conscious, and hold that the appearance of a particular 'conscious state' is subject to experimental determinism, then the origin of that state would have to result from a particular configuration and motion. After this had been discovered for a particular case, it could be predicted; it would be known that in that situation the laws of motion would change in such and such a way. Such discoveries could be continued indefinitely, for all sorts of states of consciousness. The result would at any time be a system of laws of motion comparable to that of classic mechanism, but infinitely more complex; it would be a mechanism that was always unfinished; at least until the study of all diverse states of consciousness was exhausted.

[1] See the various possibilities set forth by Pearson, *Grammar of Science*, 1911, Chapter IX.

According to the recent valuable review of Cohen,[1] strict mechanism (as nothing but configuration and motion) has not shown itself adequate to the formulation of physics. Certainly therefore it need not be accepted dogmatically for biology. Its claim to be a universal formula is not thus far supported by the science of the living.

III. Doctrines That the Universe is Biocentric.

A third class of vitalistic doctrines holds that the study of the living better reveals the essential nature of the universe than does the study of the non-living. It points out that the constitution of the universe is such that it produces life; the universe is adapted to that result (Henderson); it is of such a nature that conscious individuals arise in it. Hence it is argued that the nature of the universe would by no means be correctly discovered through a study of the non-living alone. Biology, it may hold, is as fundamental as physics, having its own original relation to reality; revealing what physics does not. All this, it appears to me, is thoroughly consistent with what we know of the living. The doctrine demands experimental determinism, and is based on the concrete results found to flow from it. Such doctrines may be carried farther, to argue that the production of conscious individuals is the central fact of the universe; that it is 'for' this that the universe exists, and the like. With such assertions the doctrine is carried outside the universe of discourse of science.

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[1] "Mechanism and Causality in Physics," *J. of Phil. Psy., and Sci. Meth.*, XV, pp. 365–386.

MECHANISM VERSUS VITALISM, IN THE DOMAIN OF PSYCHOLOGY.

I. Definitions.

IT is well, at the outset, to understand clearly what is meant by vitalism and mechanism. Both terms imply activity or change; they refer to processes in nature, not merely to static configurations. The two terms represent more or less contrasted types of process. The point at issue is whether both types actually occur in nature, or whether the changes and activities which take place in the universe may not all be reduced to a single type—the mechanistic.

Mechanism.—The distinctive characteristic of mechanistic processes is that the course of events in the sequence is rigidly *determined*. Given a certain set of antecedents, one and the same series of consequents will follow every time. If the total conditions of the situation at a given instant are known (or in so far as they are known), the results can be predicted unequivocally. If the conditions are not known to us, we nevertheless believe that the course of events in a mechanistic system is fixed, certain, unambiguous, determinate, unequivocal.

According to this definition of mechanism, which seems to be the prevailing conception of the term, and is my interpretation of its use in our Basis of Reference, a mechanistic process may be represented graphically as a unilinear series. An indeterminate process is one in which the outcome is not wholly unequivocal. Such a series may be pictured graphically by a line which forks or branches at certain points, representing alternative courses of events beyond these points.[1]

Physical and chemical phenomena, as understood today, are typical cases of determinate activity. The course of events in these domains is generally believed to be unequivocal. These sciences furnish the practical basis upon which our notion of

[1] See diagram in Bergson, *Time and Free Will*, Pogsan trans., p. 176.

mechanism is founded. When we speak of mechanistic processes we have usually in mind activities of the physicochemical type. But the two notions are not identical. So far as present knowledge goes, certain processes in nature, such as the growth of organisms and voluntary acts of human beings, though strictly determinate, *may* involve activities (or forces) of a 'higher type' than the physicochemical. Mechanism represents a generic type; physicochemical mechanism is a specific type which may or may not exhaust the genus.

Vitalism.—While the definition of mechanism given above is generally accepted, there is no agreement as to the connotation of vitalism. The name is applied by different writers to several mutually incompatible views which seek to explain vital phenomena in other terms than those of physicochemical activity. In the literature we find three distinct types of theory which take issue with physicochemical mechanism as a general explanation of natural processes. They may be classed together, though the third type is not, strictly speaking, a form of vitalism.

1. *Vital Indeterminism.*—Vital phenomena are held by some to be not entirely 'unilinear'; at certain points two or more alternative courses are (supposed to be) possible, the actual outcome in any given instance being unpredictable. In earlier days this notion was extended to inorganic nature; the actual results in certain cases were ascribed to 'chance' or 'caprice.' So far as I know, this view has no adherents among contemporary scientific thinkers. Equivocal causation is limited today to organic phenomena; the selection or choice is attributed either (*a*) to autonomy, *i. e.*, self-determination of the creature, or (*b*) to the operation of some non-physical agent working upon the material substance of the organism. These qualifications of indeterminism virtually place the interpretation in the next class.[1]

2. *Vital Force.*—Professor Wm. E. Ritter defines vitalism as

[1] As a philosophical theory only—not for purposes of scientific investigation. Driesch, *e. g.*, holds that "two systems absolutely identical in every physicochemical respect may behave differently under absolutely identical conditions, in case that the systems are living systems." (Quoted by Jennings in *Science*, 1912, 36, p. 435.) Driesch regards this view as "experimental indeterminism," but not as "absolute indeterminism." *Cf.* Bergson's illustration cited above.

the view that "something absolutely new and novel came into the world when living beings came, and that this came as a special force, or principle, or factor . . . not material."[1] While this force or factor has not always been conceived as determinate in its activity, it is today generally regarded as *subject to certain laws*. Its workings are held to exhibit certain uniformities, though these are not of the physicochemical type. The vital force is variously designated as *élan vital* (Bergson), entelechy (Driesch), or soul (W. McDougall).

The activity of the 'vital force' is generally characterized as *teleological*. This term is variously defined. Usually it signifies that the choice is determined with reference to something 'yet to come'—that the outcome is not merely the resultant of past conditions.

3. *Non-mechanistic Relationship*.—Certain writers who reject the notion of a specific vital force, nevertheless believe that the activities of organisms are not wholly explicable in physico-chemical terms. According to Kant: "Some products of material nature cannot be judged to be possible according to merely mechanical laws. (To judge them requires quite a different law of causality, namely that of final causes.)"[2] Hobhouse regards a living being as a system of "forces in which mechanical relations are qualified by teleological relations;"[3] and Professor Henderson somewhat similarly defines biological organization as consisting in "a teleological and non-mechanical *relationship* between mechanical things and processes."[4]

Professor Lovejoy describes this type of vitalism as the general doctrine that "the action of living bodies is not strictly a function of the number and spatial configuration of the particles composing them at any instant."[5] Professor Jennings points out, however, that the same may be said of non-living systems also;[6] so that this view, while it is anti-mechanistic, need not take a vitalistic

[1] "Controversy between Materialism and Vitalism," *Science*, 1911, 33, p. 438.
[2] *Kritik of Judgment*, trans. by Bernard, p. 294.
[3] *Development and Purpose*, p. 329, note. (Quoted by Henderson.)
[4] "Teleology of Inorganic Nature," *Philos. Rev.*, 1916, 25, p. 278.
[5] "The Meaning of Vitalism," *Science*, 1911, 33, p. 612.
[6] "Doctrines Held as Vitalism," *Amer. Natural.*, 1913, 47, p. 394.

form. Both Hobhouse's and Henderson's conceptions of non-mechanistic relations might be similarly extended to the inorganic realm. Henderson seems to imply this broader notion of teleology in his discussion of the "order of nature."

II. THE CASE AGAINST MECHANISM.

The opposition to mechanism as a complete explanation of the processes which occur in nature is thus seen to be of different degrees. The three anti-mechanistic attitudes may be summed up as follows: (1) Certain processes in nature are not determinate. (2) Certain activities of organisms are determined in part by a force or agent which is not physicochemical in character. (3) Physicochemical mechanism prevails universally, but it does not afford a *complete* explanation of certain natural processes; the mechanistic explanation needs to be supplemented by a teleological explanation, which takes account of relations belonging to a different order or dimension from the mechanistic.

The mechanist, on the other hand, believes that the weight of scientific evidence favors an explanation of natural processes stated wholly in physicochemical terms. According to the mechanistic interpretation, not only inorganic phenomena, but all phenomena of organic life, including those in which human consciousness is concerned, are strictly determinate and belong to the physicochemical type.

The case against mechanism is based chiefly upon four lines of argument. (1) *Inconceivability:* A thorough-going mechanistic interpretation of nature is inconceivable and impossible. (2) *Organization:* Mechanism does not explain certain observed characteristics of growth and regulation in organisms. (3) *Voluntary Selection:* Conscious introspection demonstrates that voluntary choice in human beings is not mechanistically determined. (4) *Teleology:* The adaptive character of behavior is not fully describable in mechanistic terms.

These arguments are used alike by all classes of opponents to the mechanistic standpoint. We shall examine them in turn in the remainder of this paper.

The Argument from Inconceivability.—The difficulties which

meet us when we endeavor to reach a clear conception of mechanism are not to be ignored. They are such as occur when any new scientific principles are formulated which appear to be at variance with familiar but more limited generalizations. When the theory of the earth's spherical shape was first propounded it was difficult to imagine how men could live at the antipodes without 'dropping off.'

That many such inconceivabilities and absurdities have been rendered conceivable and have eventually been adopted diminishes the weight of this argument. Yet the opponents of mechanism today lay considerable emphasis on the difficulty. Not merely do they point out the need of greater explicitness in defining and describing mechanism; but they assert that the theory at certain points is inconceivable, impossible, or absurd. Such an argument may be characterized as pseudological.

The Kantian logic bristles with this type of reasoning. The passage quoted above is an instance in point. "Cannot be judged" is one shearing-blade of its antinomy; the opposite blade with its "must be judged" is equally sharp. If we smooth down the "cannot" and the "must," the antinomy no longer cuts.

The contemporary neo-Kantians follow in the Master's footsteps. Hobhouse asserts that "the actions of living beings are not explicable in mechanical terms, and we are compelled by the evidence to admit a teleological factor."[1] He may be justified in arguing that these actions *have not yet been fully explained;* but to characterize them as inexplicable is to spar with brass knuckles.

Driesch, for all his scientific training, uses this type of argument profusely: "A theory like Weismann's is impossible."[2] "It would be nonsense to apply the concept of 'quantity' and 'measure' to something which has only to do with the *arrangement* of a manifoldness."[3] "How could a 'machine' be divided and divided and—always remain the same?"[4] As a call for 'more

[1] *Development and Purpose*, p. 329 note.

[2] *Problem of Individuality*, p. 13.

[3] *Ibid.*, p. 35.

[4] *Ibid.*, p. 22. *Cf. Science and Philosophy of the Organism*, Vol. I, pp. 138–149; note the weakness of his argument if the assertion of necessity be eliminated.

light' such arguments deserve respectful attention. As a *reductio ad absurdum* they are not impressive.

W. McDougall's arguments in certain places indicate the same mental attitude: "The behavior of animals . . . is everywhere characterized by certain features which seem to present insuperable difficulties to all attempts at purely mechanical explanation."[1] "Mental chemistry is an inadmissible notion;" it is "strictly absurd."[2] "The difficulties of phenomenalistic parallelism are then very great, indeed insuperable."[3] "Such a state of things [as correlation of pain with beneficial reactions and of pleasure with detrimental reactions] would seem to us profoundly irrational and absurd."[4]

With the argument from inconceivability may be joined its converse; the argument from *a priori* necessity, so familiar to readers of Kant. Both arguments strike the scientist as pseudological. Such voluntaristic terms as *necessary* and *impossible* exert an undue logical pressure which even the out-and-out determinist resents.

The solution of the problem before us, as of any other scientific problem, depends upon *empirical* evidence. The function of logic is merely to imitate in thought the formal relations which prevail throughout the universe. The data of knowledge are drawn from the world about us; our rôle as rational beings is to arrange these data into orderly systems which *tally with the formal relations found in nature.* Pseudological devices carry us away from such correspondence between thought and nature.[5]

The Argument from Organization.—The second indictment against mechanism rests upon the phenomena of growth and other vital processes observed in organisms. According to the vitalists these processes are inconsistent with a strictly mechanistic theory. This line of argument has been developed most systematically by Driesch. Certain crucial experiments demon-

[1] *Body and Mind*, p. 258.

[2] *Ibid.*, p. 283.

[3] *Ibid.*, p. 160.

[4] *Ibid.*, pp. 324–325.

[5] In fairness we should note an equally illegitimate tendency on the part of mechanists to characterize the vitalistic position as a phase of mysticism or magic.

strate, in his opinion, that each cell in the organism is "equipotential"; that is, it is capable of building up an entire organism. But, as a matter of fact, he points out, most cells develop only into some specific part of the organism, and the development of each cell harmonizes with that of the other cells in the organism. This would indicate, in his judgment, that the course of development is not wholly physicochemical, but is in some way controlled or directed by a non-physical agent—an entelechy.

The evidence for mechanism on this count has been exhaustively presented by Jacques Loeb in a recent work, *The Organism as a Whole*, to which the reader is referred. According to this array of evidence the phenomena of organic life *do* admit of interpretation in strictly physicochemical terms, so far as scientific research has examined them. The hypothesis of a guiding entelechy appears to be quite as redundant as the hypothesis of an agency directing the movements of the planets in their orbits.

In addition to this direct empirical evidence for the mechanistic character of vital processes, we may notice certain weaknesses in Driesch's argument. (1) His statement of equipotentiality is broader than the facts warrant. The germ cells and certain of the cells which arise in *early* development do indeed appear to be capable of producing an entire organism. But many of the cells which arise in *later* stages of growth are more specialized. They appear capable of producing only certain specific organs or certain kinds of tissue. In the frog a certain type of cell, however situated, develops only into a leg. In man the nerve cells, blood cells, etc., produce only tissues of one type. Such cells are not equipotential.

(2) Driesch's conception of 'mechanism' is too narrow. The machines devised by man are of two distinct sorts—*constructing* machines and *operating* machines. The organism is at once a building mechanism and a working mechanism. The individual cells build up the organism and the organism as a whole performs certain operations of reaction upon the environment. Driesch does not seem to recognize that a mechanism may combine both features.

(3) The structural form which arises in organisms by growth

may be due to the interaction of cells upon one another. The development of any given cell is inhibited or modified by the action of the whole organism upon it. This would explain the "harmonious" development of the entire system as readily as Driesch's entelechy.

The two remaining lines of attack upon mechanism (volition and teleology) touch upon the sphere of psychology and will be examined in greater detail.

III. THE ARGUMENT FROM VOLUNTARY SELECTION.

The supposed autonomy of consciousness in determining action is used to support the view that vital phenomena are likewise autonomous or self-determined in certain respects. If volition proves to be physicochemically determined, this presumption disappears.

The Neurology of Deliberation.—It is now generally admitted that the thoughts which precede voluntary muscular activity depend in some way upon cerebral activity. There are three alternative interpretations of this relation: (1) Thought and neural processes are regarded by some as two *distinct* but *interacting* series of phenomena. (2) They are believed by others to constitute two *independent, parallel* series. (3) They are held to constitute *one series*, which may be observed subjectively as conscious experience and objectively as neural activity. The third view appears to accord with the observed facts, and seems preferable under the rule of parsimony.

The subjective experience of thought consists in a succession of mental states whose causal relation is not directly observed. If the series of events is mechanistically related, the causal description should be expressible in terms of the neural processes which are identical with the conscious experiences. As yet these neural processes have not been measured. That nerve impulses exist we know, and we have considerable knowledge of their pathways.

While an objective description of the process of 'voluntary selection' is still more or less hypothetical, it may be stated in mechanistic terms as readily as in terms of an animistic agency.

During the period of deliberation which precedes volition neural impulses travel now along one path (or set of paths) now along another among the cortical centers. When a neural impulse reaches a motor synapse of low resistance, discharge takes place and certain muscles are contracted. According to the mechanistic view both the central course of the impulse (deliberation) and the motor discharge (volition) follow the line of least resistance.

At least three objections are raised to this as a complete explanation[1] of the occurrence. (1) The succession of thoughts is determined in part by our attitude and conscious endeavors. (2) The actual initiation of the act is a matter of conscious control. (3) We are conscious at the time, or later, that we might have acted otherwise.

Attitude lends itself, however, to description in neural terms. The course of the nerve impulse is determined not merely by the sum-total of present stimuli; it depends quite as much upon past experience. The resistance at each synapse is modified by the impulses which have traversed it in the past, and the sum-total of these modifications constitute the general *set* of the nervous system. This neural set, in subjective terms, is our *attitude*. Laboratory investigations have demonstrated that associations of various types are formed according to certain regular principles. So far as can be judged, each association follows a line of least resistance, which is determined by habit (neural set) and present stimulation.

Conscious endeavor to deliberate is one phase of attitude. In neural terms it is a *set* in some direction. It means that certain central synapses have been made permeable, so that the impulse passes from center to center instead of finding at once the motor outlet.

If we observe intently the actual initiation of a voluntary act (the so-called *fiat*), we find it characterized by extremely vivid consciousness. *Unless* it is intently observed the action takes place of itself. In ordinary cases, then, the neural activity of

[1] As here given the "explanation" is schematic and incomplete. To work out the neural details would carry us beyond the space allotted to this discussion.

volition means simply the passage of the impulse into a motor pathway through a permeable synapse. In certain specific cases this passage is preceded by an *intensive summation* of nerve impulses, and this is the neural equivalent of the *fiat*.

In attempting to describe these phenomena the real difficulty seems due to the complexity of the occurrences, not to their peculiar character. We are dealing with a vast plexus of impulses and resistances. To account for them all is practically beyond our power. Like the problem of three bodies in physics, the outcome is practically unsolvable, but it is nevertheless rigidly determinate.

The Temporal Fallacy.—The notion of 'freedom'—of the indeterminateness of volition—appears to rest upon a faulty observation of the time relations of conscious experience. Choice implies that two or more alternative courses of action are presented in consciousness, of which one is selected by the individual. The fallacy consists in assuming that these alternatives are presented in all their strength at once.

When I debate whether to spend my vacation in the mountains or at the seashore, the reasons for and against each course are reviewed successively, not simultaneously. If there are strong motives for each, these motives are considered in turn. When the decision is actually reached it is due to the motives which are strongest at that time. I may afterwards feel that I might have chosen the other course quite as readily. But this is because the motives as *now presented* are different in strength from what they were at the time of decision. The problem of expense may weigh more heavily than it did when a salary check was just deposited; the wishes or welfare of some member of the family may now appear in a stronger light. I read back the present situation into the earlier; I appear to have chosen a line of greater resistance, because this line offers greater resistance at present. Hence the belief that the choice is guided by 'my will' rather than determined by the total situation.

When one picks up a hand at bridge one finds a certain combination of thirteen cards—one out of many million possible combinations. One feels that one might equally well have

drawn quite a different assortment. What do we mean here by 'possible' and 'might'? Merely that a different shuffle would yield a different result. The shuffle *is* different next time, and the hands are different. But the two shuffles are successive, not simultaneous. The possibilities are successive—the 'might' refers to a different situation from the present. In every deal the order of cards is determined by the shuffle; it is a matter of physical forces operating on each card separately and modifying their mutual relations.

Here the situation determines one specific outcome from among many, composing a large homogeneous group, others of which are determined at other times as the situation varies. This is what we mean by *choice* or *selection* from among a number of 'possible' alternatives. The same conception of choice may be adopted in the case of human volition.

To test the determinateness of voluntary selection we should repeat the action under precisely the same conditions. Such a test, however, is scarcely ever practicable. We do not succeed in shuffling a pack twice the same way. Similarly, the situation preceding voluntary choice is always novel in certain essential particulars. Nevertheless, a situation may be new to the individual, and yet may be substantially repeated in different individuals. The temptation to marry, the temptation to commit a crime of some sort, occurs to many persons at one time or another. Mass statistics on both of these phenomena are available. They exhibit remarkable regularity from year to year in a given environment. Even the number of suicides in a community is surprisingly uniform—and this is certainly a new situation in each individual instance. In the case of marriage also the situation is generally novel.[1] Variations in the statistics from season to season and from year to year indicate that the selection is largely determined by temperature and climatic conditions, by food supply, and by factors of the social environment. That is, given an individual's inherited disposition, his choice of conduct in the matter of marriage, crime, and suicide is 'regulated' by environmental conditions, not by his arbitrary fiat.

[1] The statistics do not indicate the number of 'temptations' which are resisted; but this does not affect the argument.

After studying these statistics the writer is more firmly convinced that volition is completely determined by physicochemical antecedents than he is of the fact that inanimate nature is mechanistically controlled. My 'luck' at cards is more difficult to explain without assuming a guardian angel or a malignant demon, than my conscious, voluntary actions.

It is admitted that the evidence does not *demonstrate* the falsity of the animistic interpretation. In every case, organic and inorganic, two alternative explanations are offered: (1) regularity of action, ascribed to an unstable equilibrium of related units in a system; (2) irregular changes, due to an agency outside the material system working upon the units. For the scientist the former interpretation presents the line of least resistance.

IV. The Argument from Teleological Activity.

The vitalistic hypothesis claims support in the fact that organic phenomena bear reference not merely to their antecedents in the past but to future conditions and situations. This is true not only of conscious behavior but of growth and other vital phenomena. I plan and execute my actions with reference to the coming vacation. The development of the embryo yields organs which are devoid of present utility but which later will serve to nourish and protect it. Our description of behavior and growth is incomplete if we merely trace the causal sequence as we do in inorganic processes. The scientific treatment of vital phenomena involves taking into account the future outcome as well as the antecedents.

This is only part of the story, however. In the case of behavior the conditions are extended in *both* temporal directions. The creative activity often has reference to the more or less remote past as well as to the future. A bird becomes gun-shy as a result of some experience. Thereafter when she sees a gun her reactions are conditioned not merely by present stimuli, but by the residual effects of the earlier situation. The mnemonic factor enters into our explanation of behavior in some form or other—either as neural set or as memory image.

There is also an extension of the *spatial* factors in behavior,

though this is not so obvious. An organism reacts to distant stimuli, or rather to distant situations. We converge the two eyes with reference to a certain 'depth.' When the conductor shouts 'All aboard,' we run faster if we are further away from the train. We reach to right or left according to the direction of the object and put forth greater or lesser effort according to its degree of remoteness from us.

The word *teleology* may be used to denote this temporal and spatial extension of the conditions in certain organic phenomena.[1] The recognition of teleology by science does not *ipso facto* imply acceptance of indeterminism. Neither does it involve the admission of exceptions to the general principles of physicochemical action. Teleological activity may be described in terms which harmonize completely with our notions of physical causation. The conception of mechanism is broadened somewhat, but we find no discontinuity-point separating the physicochemical sphere from phenomena of a 'higher order.'

Distant-reception.—The principal distant senses of animals are sight, smell, and hearing. In each of these the stimuli come from objects or sources more or less remote from the creature. The stimuli travel toward the animal and affect the appropriate receptor. The stimuli as such are not distant, but the source remains distant and *continues to send out waves or emanations* toward the receptor. The situation is analogous to telegraphy, where a transmitting operator manipulates the key and a receiving operator, perhaps a thousand miles away, receives the message. The transmitter remains at a distance during the entire operation, but his activity and the activities of his instrument play an essential rôle in the process. A complete scientific description of telegraphy involves reference to the source of transmission.

Similarly, distant reception and the resulting reactions are not completely described in terms of the *impinging* stimulus. The distant source is an essential factor to be considered. In

[1] The two terms, *teleology* and *purpose*, are usually employed interchangeably. But *purpose* connotes temporal extension only. On etymological grounds the meaning of teleology may be broadened to include spatial extension of the conditions as well.

explaining telegraphy the recognition of the distant source implies no modification of the laws of causation. It merely indicates a certain complication of the causal processes in such types of activity. The same appears true in distant-reception.

Memory.—The mnemonic factors in the antecedents of behavior are not present stimuli, but dispositions of some sort in the cortical tracts. When I recite 'Mandalay' or steer a sailboat around a buoy, the immediate stimuli are not the sole causal factors. Past experiences have altered in some way the central synapses if not the neural substance itself. These 'prepared' central conditions are essential factors in the process; a scientific description of my activity involves taking them into account. This may be expressed in various ways. If may be said (1) that my present cortical set is a factor in my activity; or (2) that my memory of the poem or of the art of sailing enters into the process; or (3) that my past experiences in memorizing the poem or learning to sail are one of the antecedents of the present action. These are all abbreviated descriptions of the temporal extension.

The third form of statement is the most satisfactory, since it emphasizes the earlier occurrences which produced the cortical set and built up the memory. To describe the mnemonic factor merely in terms of present neural dispositions is to miss an essential point. Memory is conditioned by the *original experiences* which produce the set, in the same way that perception is conditioned by the *distant objects* which generate the stimuli.

To say that my reading of Mandalay years ago is one of the 'essential' antecedents of my present memory experience does not imply that time is syncopated—that the 'past' is 'present.' The causal sequence holds in full mechanistic form. But in describing memory phenomena the statement is abbreviated for convenience. Just as we say $9 \times 6 = 54$, instead of adding 6 to 6 again and again, so we speak of the original sensory experience as a direct antecedent of the present recall.

Purpose.—When we act with reference to a future situation the causal relation is more complex. In a former paper this type of activity was examined at some length.[1] Briefly, pur-

[1] "A Study of Purpose," *J. of Phil., Psychol.*, etc., 1916, 13, Nos. 1, 2, 3.

posive actions depend upon distant-reception and memory. When a ball is coming toward me I *prepare* to catch it. Part of the future situation is already given through *distant-reception*: I see the ball coming before it reaches my hands. Part of the future situation is also given by the *memory* factor: I represent the coming situation in terms of similar past experiences.

In the article referred to, purpose was defined as an "inversion of the temporal order." This is merely another shorthand formulation. In ordinary causal series the order would be (1) sight of the object, (2) contact, (3) reaction of some sort, such as grasping the ball, eating food, etc. In purposive action part of the reaction (3) precedes the contact (2). Professor Perry[1] points out that in the case of a dog chasing a rabbit the digestive process actually begins before the dog catches his prey. Here the reaction is started before the significant part of the stimulus occurs. Such an inversion of order is characteristic of purpose; it is an *anticipatory* reaction, but the process is mechanistically performed.

Purposive activity is thus seen to be a special type of causation, not a mode of change opposed to the causal type. The same was found true in the case of memory and distant-reception. Teleology in general, then, is a specialized form of causal process, which arises through certain extensions of the spatial and temporal range of the antecedents. Only the complexity, it appears, hinders us from describing the process completely in terms of physicochemical mechanism.

The Pattern Concept of Teleology.—Driesch offers as one of his arguments for vitalism the fact that organisms present certain peculiar patterns or forms. Professor Henderson, while denying the truth of vitalism, also emphasizes the pattern or order of certain phenomena in the universe.

These and the more or less similar views of Bosanquet, Hobhouse, and others indicate a sense of dissatisfaction with the postulates of physicochemical mechanism. With the exception of Driesch the authors mentioned admit the universality of mechanistic causation. They believe that the causal process is

[1] "Docility and Purposiveness," *Psychol. Rev.*, 1918, 25, p. 16.

supplemented in some way by another factor which belongs to a different order.

Bosanquet conceives this factor to be the principle of Value, and makes Teleology a subform of this principle. If teleology "is to retain a meaning, . . . it must fall back on the characteristics of value which, apart from sequence in time and from selected purposes, attach to the nature of a totality which is perfection."[1] Psychophysics points the way to a scientific definition of "value," but "a totality which is perfection" conveys no more meaning to the present writer than "a thirteen which is redness."

Driesch's expositions are clear if not convincing. He illustrates his pattern concept by a diagram.[2] On one side are sixteen units arranged to form a square—a regular homogeneous pattern; on the other side these units are arranged in trident form to represent roughly the shape of a plant. The latter form, he believes, can be derived from the homogeneous arrangement only by the action of some non-spatial agency.

This argument, indeed, reaches beyond the sphere of the organic. If the specific forms of organic species are puzzling to account for, the contour of certain inorganic systems is no less so. Why, for example, the peculiar outline of the North American continent? How explain, from homogeneous matter, the pyramidal shape of the Matterhorn, marking the boundary between three great linguistic stocks, each of which terminates at one of the three bases? How account for the preponderance of certain chemical elements in the world and the rarity of others?

Professor Henderson sees the implications of this reasoning and accepts them. Without denying the universality of mechanism in nature, he points to certain facts as evidence that a preëstablished eternal pattern or order exists in the cosmos. In the constitution of the three common elements, C, H, and O, and of certain of their compounds, and in the wide distribution of these elements and compounds, he finds evidence of a "teleological" factor inherent in the universe itself. We need not repeat his catalogue of these peculiar properties, which he de-

[1] *Individuality and Value*, p. 126.

[2] *Problem. of Indiv.*, p. 51.

scribes as *maxima*, as the "fittest possible" for the fostering of organic life.[1]

We may raise at least two objections, however, to Professor Henderson's argument. In the first place it is *ex post facto*. The evolutionist holds that organic life has grown up *as it has* as a result of conditions which *actually exist*. If carbon were absent or rare, possibly another type of organism would have evolved, based upon silica compounds. If the properties of elements had been otherwise, we might expect to find different types of organisms, exhibiting different characteristics. If the earth's surface were mainly land, possibly fresh-water or aerial organisms would have arisen earlier than marine types. In other words, evolution is a process of adaptation to the *given* environment. Whatever environment is present is presumably *fit* for the types of organism which evolve within its limits.

But there is another weightier objection to the argument that the present environment manifests maximum fitness for *any* form of life. The cosmic processes apparently result sooner or later in solidifying any given world. The moon no longer supports life. It is believed that our own earth will also grow cold in time and will no longer afford a habitat for any kind of organic life. If we are seeking for *maxima* of fitness, here is at least one point where the actual physical constitution of the cosmos fails us. It does not rise above the minimum. One may therefore regard Professor Henderson's enumeration of characteristics as an interesting catalogue—and nothing more. It does not establish a *maximum* fitness in the order of nature.

Teleology and Fitness.—One important fact remains to be noticed in connection with organization and behavior. Organic evolution is an orderly process—just as physical and chemical processes are orderly; but a further notion, in addition to "regularity," is needed to bring out the full meaning of organic phenomena. This is variously expressed as 'adaptation,' 'adaptiveness,' 'adaptedness,' 'adjustment,' 'suitability,' 'fitness.' The growth of organisms brings into existence certain structures

[1] *The Fitness of the Environment*, chaps. VII, VIII; *The Order of Nature*, chaps. VIII–X.

which *meet the conditions* of the environment. Instincts are evolved which are *fitted* to prolong life. Through the learning-process habits are developed in the individual which are *adapted* to his situation in life.

Fitness may be regarded as a dynamic harmony in nature, which supplements the static harmony of physical phenomena and inorganic chemistry. The term 'harmony,' however, is no easier to define than 'fitness.' What does the general notion of fitness or harmony in organic phenomena imply?

The notion of fitness as applied to organisms implies their viability; as applied to growth-processes and behavior it implies a result which increases the organism's viability. To this extent the phrase 'survival of the fittest' is tautological or inverted. But we find empirically that behavior tends to coördinate in such ways that the reaction is accomplished with a *minimum of energy*—with the *least superfluous motion*. In the processes of growth and regulation a similar tendency is manifest. Vital processes tend to meet the conditions of the environment with a *diminishing expenditure of energy*—with *less friction* or waste motion. This seems to be the physicochemical meaning of fitness or harmony. It is an extension, through the operation of natural selection, of the general principle of equilibrium in nature.

Teleology, in the sense above defined, is the chief factor in producing the state of organic equilibrium called fitness. That is, *distant reception*, *memory*, and *anticipation* all tend to cut out waste motion and accelerate the tendency towards fitness. These processes, together with natural selection, may be regarded as but a further instance of that general 'harmony' which appears in all aspects of the universe.

I see, then, no real difficulty in subsuming anticipation and fitness under the general program of physicochemical mechanism. They may be treated as short-hand expressions for a certain complex type of causal phenomena. We do not regard the processes of multiplication and 'powering' in arithmetic as contradicting addition, nor as novel processes discontinuous with the latter. They are merely abbreviated methods of performing

the addition process. In the same way the scientist may treat purposive activity or either of the other teleological modes as special, complex forms of causation falling under the general physicochemical type. Fitness may be regarded as a special, complex form of equilibrium. As such it belongs within the wider general sphere of mechanism.

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MECHANISM VERSUS VITALISM AS A PHILOSOPHICAL ISSUE

THE issue[1] raised between the vitalist and the physicochemical mechanist is evidently one that cannot be fully met until the experimentalist secures all the relevant evidence. When this complete evidence will have been secured or that it ever will be secured, of course no one knows. In the meantime we witness two distinct controversies, the one properly engaged in only by experts in physiology, biochemistry, experimental zoölogy and botany, and psychology, the other properly engaged in by any philosophically minded student. In the former controversy the participants set forth the phenomena and properties of living things, examine the hypotheses offered as solutions of problems thereby raised and the evidence on which these hypotheses rest, and weigh the probability that admittedly unsolved problems may in the future be solved by analogous hypotheses. Here the biological expert alone deserves a hearing; and the only part of this field in which I might venture to offer opinions is psychology. However, as even a brief survey of the psychological evidence would require all of my allotted time, I am leaving to my colleague, Professor Warren, the responsibility of presenting the issue between vitalism and mechanism within psychology, and I shall confine my paper to this issue studied only as a philosophical controversy.

Here again I wish to limit my paper. As I have completely

[1] If I interpret correctly our 'Basis of Reference' (*J. of Phil., Psychol.*, etc., Aug. 15, 1918, pp. 460–461) vitalism is to be distinguished from mechanism not by some principles *merely additive* to physicochemistry but by principles that *contradict* physicochemistry. For example, it was the belief of at least a few of the leaders in this discussion that Driesch holds that some vital phenomena contradict the second law of thermodynamics. Accordingly, in this paper I include within mechanism not merely the doctrine that physicochemistry is sufficient to explain life, but also the (neutral, if you prefer) doctrine that merely additive principles may be required; whereas by vitalism I mean any doctrine which teaches that life presupposes entities, agents, or principles which contradict physicochemical mechanism as defined in our 'Basis of Reference.'

lost faith in every form of rationalism and transcendentalism, I must leave to those who retain such a faith all serious study of any *a priori* method of meeting the issue between vitalism and mechanism. Thus limited, the issue as a philosophical controversy has remaining at least three aspects. First, the issue needs to be defined and the rival hypotheses need to be made thoroughly explicit. This task belongs properly to the metaphysician, or logical analyst. Second, the issue is an eddy in the main current of modern European intellectual development and should be studied from the point of view of the historian of philosophy. Third, the issue involves only a part of man's universe of study and discourse and in this sense is abstract. Hence if there can be such a study as that of the concrete total, or universe, then the vitalist and the mechanist must give a hearing also to the student who endeavors to view the problem of life from the standpoint of the concrete total. I shall confine my paper to the two former aspects, the logical and the historical, and leave to my colleague, Professor Hoernlé, any discussion that may be based upon the third study, or that made from the point of view of the concrete total.

Studied from the point of view of the metaphysician, the problems raised in the issue between mechanism and vitalism are no new ones; for they have been prominent in the thought of the past three centuries. At the one extreme is the belief that the universe is logically continuous, is fundamentally a mathematical world; and at the other extreme is the belief that the universe is alogical and can best be described in such prescientific language as that of the layman, the poet, and the animist. That is to say, the issue represents two radically different philosophies, that of modern science and that of modern romanticism.

The philosophy of modern science is manifested in the holding of the following scientific attitudes or principles. First, determinism. This principle asserts that all facts or phenomena can be explained or accounted for, or are conditioned. Two different events presuppose different conditions and these conditions are discoverable. In short, facts can be deduced. Second is the

principle of analysis. This asserts that the complex can be analyzed into the relatively simpler and the structure, or way in which this 'simpler' is organized to make the complex. Third is the principle of simplicity, or paucity. This asserts that the ultimate simples and the ultimate premises upon which explanation, or deduction, rests are relatively few and that science should endeavor to discover their minimum. Fourth is the principle of independence. This asserts that the ultimates of explanation are logically independent, that is, one does not presuppose the others. From these principles follows what is well called the logical continuity of science *as an ideal*. The special sciences tend to order themselves as logically prior or posterior; and as science progresses, we approach as a limit one deductive science in which all the special sciences or bodies of explanation follow from logically prior sciences and these ultimately from mathematical sciences. In short, at the limit there is but one type of explanation and this is mathematical.

Within this larger philosophical creed the part to be included within biological mechanism is evident. All mechanists believe that whatever life may prove to be, no vital phenomena will be found to be inconsistent with physicochemistry; and the extreme mechanist believes that the phenomena both of life and of mind will in time prove to be *fully* explicable in terms of this logically prior science. All believe at least that it is the business of the biologist and psychologist to explain the phenomena studied by them physicochemically *as far as they can*. The extreme position is held, if I mistake not, by Loeb. Of the mechanists who are scientifically less optimistic, some find in mind and others find in both life and mind, that which is logically discontinuous with physicochemical mechanism. The English physiologist Noel Paton holds, I believe, the former position and the English biochemist Benjamin Moore the latter position. According to the former (widely held) position, mind is not inconsistent with the physicochemical but is additive. It may be merely a series of epiphenomena in one to one correspondence with the physiological or it may be a genuinely novel agent, organization, or energy. According to the latter position, life also may be

more than the physicochemical. There may be a genuinely new energy, *a vital energy*. This energy, if I understand Moore correctly, is comparable to molecular energy in that it cannot be exhibited by entities of lower complexity and in that it is the consequence of organization of a higher order. I find at least three distinct and fundamental doctrines held implicitly among these moderate and more numerous mechanists. First, there are facts or phenomena that are non-mechanical but are in one to one correspondence with the mechanical and are to be explained through the configurations with which they correspond. Such a doctrine is held widely among psychologists and is a double-aspect theory. Second, organization exhibits new properties, properties that cannot be deduced from the properties exhibited by the relatively simpler structures that are members of the organization. This view seems to me to be held by Moore. Third, life reveals the presence of new principles or new energies that are logically independent of the properties or energies present in the lifeless. The former properties or energies are, however, not inconsistent with the latter, for they are merely additive. This last doctrine seems to me to be held explicitly in Ostwald's suggestion of a 'psychic energy.'

Though there are evident compromises with vitalism in these moderate mechanistic doctrines, still they all are purely additive to physicochemical mechanism; and they all hold out the possibility of explaining life. They all are deterministic. They all in these two senses believe that science can win in the long run.

In contrast, vitalism, as defined in our 'Basis of Reference,' limits the extent to which the universe of fact, or observable data, can be explained. The extreme romanticist, who as such is a vitalist, tells us that nothing can be explained. It can only be intuited. Or he tells us that only the spatial can be explained; for science is but mathematics, and mathematics, he adds, is a study only of the spatial. The moderate romanticist—the vitalist especially, with whom we are concerned—finds in life, or at least in certain aspects of life, facts that are inconsistent with physicochemical mechanism; and these facts defy explanation, that is, they are indeterministic. Different vitalists of

course differ as to the types of facts they enter upon this list. Perhaps the two sets of facts that are most prominently regarded as indeterministic are the unity or regulation of the organism as a whole, and the teleological or purposeful aspect of vital phenomena. These at least are alogical; and therefore here at least science must forever fail. In place of explanations we are offered terms and propositions that defy further logical analysis. Either they are the mere contradictions of the terms and principles of science, or they are the foreign terms and propositions of prescience. At the best the latter can be intuited or can be described figuratively. Without intending any offense, I must confess that I find these terms and propositions to be of the same type as those of primitive magic and animism. Indeed, vitalism is either an explicit or implicit animism, as the vitalistic psychologist MacDougall most consistently shows.

Now if the history of science reveals anything, it manifests that science became science by outgrowing animism. Science and animism are contradictories. So are science and vitalism the moment the vitalist offers 'an explanation of life.' However, it may be claimed that only rationalism would rule out animism as a possible scientific hypothesis; for if the facts call for this hypothesis, why should not the experimentalist accept animism gracefully? Why slander the open-minded scientist because he is an empiricist? How can we decide *a priori* that animism cannot be true? My reply is twofold. First, of course animism may be true; at least I am not questioning its being true. Certainly there is no *a priori* proof that it is false, or even that nature is not alogical. Second, and this is my only point, animism is not a scientific hypothesis; for animism is not additive to physicochemical mechanism but contradicts it. Nay more, animism asserts that in part nature cannot be explained scientifically, that nature is in part inexplicable. Animism is fundamentally indeterministic; whereas explanation presupposes determinism. In short, animism is not an explanation; for when critically examined, it proves to deny the possibility of explanation.

Here some may protest: "Some animists are explicitly determinists. They assert merely the existence of an entity with

powers other than those studied in mechanics, physics, and chemistry. Souls may behave as uniformly as do atoms and may lend themselves to experimental enquiry as readily as do bodies." To such protestants I reply: Let us not quarrel about words. Such animism is not the historic doctrine, nor is it the animism of the vitalist. An animism that does not contradict physicochemical mechanism but is merely additive, and that asserts the existence of an entity which lends itself to experimental enquiry, or is deterministic, seems to me to assert nothing more than an unknown X, which if known, would explain life. It lacks any positive hypothesis over and above the pointing out of the novelty and uniqueness of life and mind. It is merely the denial of the sufficiency of physicochemical mechanism. It is not the animism of MacDougall; nor is the soul whose existence it asserts, the entelechy of Driesch.

But some may still object: "You do not say what animism *is*; for your description is merely negative." I admit the point and even add, I do not know what animism *is*. Animism defies logical analysis except in negative terms. Of course we are told what a soul does; but we are told also what magic does and what fairies do. The best that I can do in defining such entities is to call them indefinables, or to call them things that can be defined only by negation, or possibly to call them things of which contradictory attributes are asserted. To the logical analyst souls seem round squares. They are complex yet simple. They have structure but remain unities. They are wholes without parts. They are creative agents but need no fuel; for they bring about changes in the physical world merely by their *fiat*. If they explain anything, then I fail to see why they do not explain everything. They belong to the alogical universe so admirably pointed out to us in our generation by the romanticist Bergson, a universe that he shows us is open only to our intuition.

Let us here turn from logical analysis and view vitalism and mechanism as related to major movements in contemporary thought, examining especially the motives behind these rival doctrines. If the preceding analysis has been correct, the issue between vitalism and physicochemical mechanism is part of a

larger conflict taking place throughout the entire history of European thought and in particular of modern thought. It is part of the struggle between modern intellectualism and modern romanticism. It is not merely a difference of opinion arising between two judicial biologists examining facts and weighing evidence; for it is also a difference in religion, or emotional attitude.[1] In short, each intellect betrays the presence of 'a Freudian wish.' The mechanist *hopes* that science will win. The vitalist *hopes* that science will fail. And this is true though both men are numbered among scientists. The wish is father to their thought.

The different consequences of these rival wishes are momentous in the emotional life of man. If science wins, the world will prove to be one in which man is thrown entirely upon his own resources and skill, upon his self-control, courage, and strength, and perhaps upon his ability to be happy by adjusting himself to pitiless fact. If science fails, there is room for the childlike hope that unseen powers may come to the relief of human weakness. If science wins, the world is the necessary consequences of logically related facts, and man's enterprise, in Huxley's figure of speech, is the playing of a game of chess against an opponent who himself never errs and never overlooks our errors. If science fails, the world resembles fairyland, as matter of great anthropological and psychological importance; and man's enterprise either is no longer a task for skill and knowledge or is conditioned by the 'goodness' of man's will or is in part a game of luck. Historically considered, the wish behind the belief in the victory of science is the motive prominently manifested in civilization in general, and in particular in vigorous, progressive, and youthful periods of history; whereas the wish behind the belief in the defeat of science is the motive markedly manifested in a people's childhood and old age, in general in savagedom and in periods of decadence

[1] I find the words of Loeb in the preface of his book, *The Organism as a Whole*, especially apt: "The book is dedicated to that group of freethinkers, including d'Alembert, Diderot, Holbach, and Voltaire, who first dared to follow the consequences of a mechanistic science—incomplete as it then was—to the rules of human conduct and who thereby laid the foundation of that spirit of tolerance, justice, and gentleness which was the hope of our civilization until it was buried under the wave of homicidal emotion which has swept through the world."

or defeat. Psychologically considered, the wish behind the former belief is a symptom of vigor, independence, and mastery; whereas the wish behind the latter belief is a symptom of weakness, fatigue, dependence, waywardness, and failure.

But am I right in finding 'a Freudian wish' behind vitalism which connects vitalism at once with romanticism, or is my assertion of this connection a gross exaggeration? In a sense it is of course an exaggeration; for no civilized man is so much a romanticist that he is never an intellectualist and no intellectualist fails at times to be a romanticist. And what is true of men is true also of man, or the great historical movements. In modern thought the two movements or tendencies are to be found interfused in numerous proportions. Still we are justified in dividing men into romanticists and intellectualists; and we are justified in connecting vitalism with the romantic tendency. At least all romanticists are vitalists. Moreover, a psychologist cannot read a markedly vitalistic or a markedly mechanistic book without detecting on the one hand the complete absence of regret on the part of the vitalist that if his vitalism be true, science cannot explain life, and on the other hand, the desire of the mechanist that science should win. Compare, for example, Driesch and Loeb. No one can call them neutrals examining a body of evidence.

Consider further what may be called *the impatience of vitalism.* All admit that the study of vital phenomena reveals everywhere unsolved problems; but the vitalist seems to forget that the past one hundred years have had a marvelous record of physiological and biochemical victories. Again, the vitalist seems to neglect the truth that whatever life may prove to be, part of the seeming failure of science is certainly due to the fact that life has proved to be vastly more complex than the biologists even of a generation ago believed it to be. For example, the vitalist seems completely to neglect the fact, as Professor Henderson has pointed out, that we are still ignorant of the physicochemical structure of the living cell and that until we do know this structure no one can know how far physicochemistry can or cannot explain life. If the ambitious hopes of earlier days have proved absurd, this is not

due to an inability of science to progress; for science has progressed beyond even the dreams of our fathers. Rather it is due to the immense but unknown complexity of nature. What then would be the reaction of one of a judicious mind toward our present obstacles and failures and toward our vast ignorance? Would he not reserve judgment, admitting our ignorance and difficulties but at the same time urging the experimentalist to keep trying? Would he admit the failure of science and urge a rival anti-scientific hypothesis? The answer seems to me evident: we are not dealing with a judicial mind.

Here at once the advocate of the vitalist will protest that my question is unfair. It is not because of our ignorance and failures that the vitalist is ready to admit the permanent failure of science, but because we have positive evidence that science must fail. We have positive evidence that life contradicts the physicochemical; for *it is inconceivable that a machine can do what life does.* Now it is not my purpose to examine the evidence here in question, for that would require an expert biologist; but I do wish to examine this protest as a logician and a psychologist.

The argument from the inconceivable is utterly fallacious; for it is really only an argument from ignorance. That machines, as we know them, should do things inconsistent with their properties is indeed inconceivable; for it contradicts a mere truism. But nothing can be inferred regarding physicochemical machines as we do not know them; for whether or not there are such machines and what they can or cannot do—all this remains to be discovered. Is the living cell merely a physicochemical machine? We do not know. If it is merely a machine, what can or cannot this machine do? We do not know; for never have we observed mechanism of such complexity. We are, as it were, savages disputing regarding the nature of a thunder shower. The chemistry the vitalist pronounces inadequate to explain life, is of course the chemistry we know. From all of which nothing follows regarding the chemistry which we do not know. Again, it is urged, that a homogeneous entity should of itself undergo differentiation is inconceivable. True, but it is certainly an open question whether or not the ovum is such a

homogeneous entity. At best we are ignorant.[1] Finally, it is urged that it is inconceivable that a machine should have two or more different lines of action open to it at the same instant. Of course it is inconceivable, if the very definition of a machine makes it a contradiction in terms. But do we know regulation, regeneration, and similar vital processes well enough to prove that they are truly comparable to the behavior of this inconceivable machine? We do not.[2] In short, the argument from the inconceivable reduces to some such statement as this: If the living organism is a mere chemist, it is a vastly better chemist than we are. Limited to our present practical chemistry, its deeds seem miraculous.

But philosophically this argument from the inconceivable has another fallacy; for the vitalist who pronounces life an inconceivable physicochemical process, and therefore scientifically inexplicable, offers himself at once an inconceivable explanation. By mere definition he gives us a miracle-worker; but surely such a definition does not make miracles conceivable. In short, he does not object to the inconceivable as such. What then is he really trying to prove? That life is really inexplicable, that it can be observed, but that it cannot be understood. He is a romanticist.

Vitalism as a positive doctrine and vitalism even as a mere negative doctrine are interesting also psychologically. Animism is clearly 'a call of the wild'; and agnosticism also has been a notorious aid to faith by making room for the will to assume primacy over the intellect. That is to say, the very fact that the vitalist does more than reserve his judgment is psychologically suspicious. It is evidence not merely that he does not want science to succeed but also that he wants something positive. He wants life to be genuinely creative, that is, to possess powers which are inconsistent with the principles of physical science.

[1] But Professor Conklin and others are showing that the cytoplasm of this cell is already differentiated into zones that are to become different parts of the embryo. In short, the ovum is already the embryo. *Cf.* Loeb, *The Organism as a Whole*, pp. 128 f.

[2] For example, regeneration instead of being an assumption of a new line of action on the part of living tissue may prove to be merely an old line of action heretofore inhibited but now freed from the inhibitor.

He wants life to be indeterministic and mysterious. He wants the world to contain creative teleological agents; for such a world seems more in tune with the heart of man. In short, he wants the religion of romanticism.

In contrast, the mechanist also has a religion, but a different religion. He wants the world to prove simple, explicable, and manageable. He wants man to be lord of creation and master of his destiny. He wants man to be self-sufficient, self-controlled, and morally the ultimate jury. For him, man's supreme enterprise is civilization, justice, and enlightenment.

If the foregoing analysis of the two rival hypotheses is correct, we now face the question: Which is true? Can philosophy answer? I believe it cannot. The ultimate test of truth and right is not logic or argument, but fact or perception. The most that philosophy as a scientific pursuit can do, is to lay bare or make explicit the dogmas, hypotheses, terms, and inferences of men. It cannot give them their sciences, their morals, or their religion. With Fichte, I would say that a man's philosophy depends upon what sort of a man he is; for at bottom argument depends upon a willingness to conform to certain rules and to adopt certain premises and the adoption of these rules and premises must precede the argument. In short, the controversy between physicochemical mechanism and vitalism is not one regarding facts, or observed data calling for scientific explanation, but is one regarding rival philosophies. And the destiny of these rival philosophies the future alone can reveal; for the past reveals them only as rivals.

What, however, the philosopher, the historian, and the psychologist can discuss, is the consequences of the rival philosophies if consistently carried out in action. That is, we can meet the issue pragmatically. If we state what we want, these students can help us to choose our philosophy. If we want civilization, if we want man to depend upon his skill rather than upon hypnosis, we must encourage him to try to understand his environment and himself and to learn how to control himself and his environment. If we want enlightenment we must encourage experimental research and the belief in determinism which it presupposes, we must encourage men to believe in a logical world.

If we want man to be master of his destiny, we must preach the religion of effort, and of self-confidence. However, if we want the life of the vagabond, the adventurer, or the quitter, or if we want peace and rest; then we need a philosophy which leaves open as a credible religion that of animism, magic, and hypnosis.

To stop here would be doing romanticism and vitalism a gross philosophical injustice; for there are other wants, wants possessed even by extreme intellectualists. From the point of view of these wants, intellectualism has its dangers and romanticism has a most valuable protective influence. Intellectualism is liable to the faults of youth and adolescence. It is liable to be overconfident and even arrogant. It is liable to be doctrinaire, to be satisfied with a simple solution of complex problems; whereas complex problems require complex solutions. It is liable to become a dogmatic rationalism and to forget its own inductive and experimental origin. It is liable to forget that fatigue and old age are facts and that as facts they too have the right to be heard as witnesses. Finally, it is liable to forget that even science admits the possibility or even probability of the ultimate failure of civilization and of man's other enterprises, that all that the heart of man desires may not be obtainable through human skill, that man's powers are limited and that nature may prove to be too refractory. In particular, against the mechanist's liability to rationalism vitalism is a corrective because of its empiricism. It keeps pointing out new facts, new problems, and new difficulties. In so doing, it seems to me, that vitalism has already been of marked help to biological science; for it has turned the attention of the biologist to presuppositions in his theories which he was overlooking. Again vitalism protests against the tendency to over-simplify, a tendency present throughout the history of science. Whatever life may be, it is far more complex than it used to be thought to be. Here too I believe that vitalism has been a most valuable check to the self-confident mechanist. Finally, vitalism is a protest against the tendency to minimize the teleological that as mere fact is present in life, no matter how it is to be defined and explained.

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MECHANISM AND VITALISM.

1. The problem of Mechanism and Vitalism may be regarded as single, but it is certainly far from simple. Recent discussion has shown it to be the meeting-point of a veritable maze of questions, touching experimental facts on one side and logical principles on the other. What is meant by 'mechanism'? What are the limits, if any, of a mechanistic explanation of natural phenomena? How many different types of theory sail under the common name of 'vitalism'? Do living beings in their structure, growth, behavior exhibit features incapable of being explained in physico-chemical terms? If so, must we refer them to a special vital force? What is the nature of this force? What is its mode of operation? Can any theory on this point be tested and verified by experiment? If not, is such a vital force anything more than a fiction, at least for a science which seeks to be strictly empirical? Yet, without such a factor, is there any way of accounting for the difference between the living and the non-living? What, again, is the relation of biology to physics and chemistry? Is it a department of these latter sciences, or is it autonomous, with a field of facts and with characteristic concepts of its own? Suppose we decide for its autonomy, how does this affect the ideal of a unified theory of nature? Does this ideal commit us to seeking the explanation of all facts in terms of the smallest possible number of concepts? And should these concepts be taken exclusively from the physical sciences?

These and similar questions have been interwoven in the recent literature of our topic. They are obviously closely connected with one another, yet no less obviously a discussion of each of them on its merits requires an expertness in so many different fields of knowledge, that hardly any single thinker nowadays can hope to handle with equal competence all sides of the problem. The best results may be expected from the sympathetic coöpera-

tion of scientists and philosophers. And if coöperation is spiced with a dash of controversy, so much the better. For controversy is the medium in which theories grow in precision and have their logical stability searchingly tested. Nor ought we to forget, on this occasion, that to the historical development of mechanism and vitalism philosophers and scientists have equally contributed. It is enough to recall, prior to the nineteenth century, such names as Aristotle, Bacon, Galileo, Descartes, Newton, Leibniz, Hume, Kant, in order to realize that our topic has been one of the chief meeting-points of experimental research on the one side and philosophical speculation on the other. It is no mere accident that Hans Driesch, in thinking out his vitalistic theory, found himself driven into fundamental problems of logic, and that the advocate of a mechanistic theory, on his side, is much more of a 'speculative' philosopher than he is himself aware of. We may thus take it as a happy omen that scientists and philosophers have been found willing to coöperate in our present discussion.

2. The thesis which I shall try to support, and the bearing of which on some of the problems above enumerated I shall try to draw out in the following sections, may be summed up in the formula: Not mechanism *or* vitalism, but mechanism *and* teleology. The 'universe of discourse' of our discussion is best described, in Henderson's happy phrase, as "The Order of Nature"; and biology is our best door of entry into it. For biology can hardly avoid the *larger issues of context* which are suggested by the appearance of living beings in nature, of organisms built upon and growing out of the inorganic. However much the worker in biology may seek to limit himself to the phenomena of life *as such*, to the problems of structure, growth, behavior, without troubling himself about the larger questions of the origin and status of life in the system of nature as a whole, still even the most superficial acquaintance with biological literature shows that such isolation is largely artificial, and always on the point of breaking down under the pressure of the desire for fuller knowledge. It breaks down, first of all, because, whilst physicist and chemist can ignore the phenomena of life, the

biologist cannot ignore the phenomena of physics and chemistry. The living beings which he studies, whether single cells or multicellular organisms, are far too obviously physico-chemical systems. Once the breach has thus been made, the whole tide of wider issues sweeps in. Beginning with the difference between the living and the non-living, there comes next into view the problem of the way in which the phenomena of life are conditioned by their occurrence in bodies, *i. e.*, in physico-chemical systems, and, again, by an environment, partly itself composed of living things, partly non-living. And once this point has been reached, the "order of nature" confronts us as the context within which the other questions must find their answers. Our 'Basis of Reference,' however it may be criticized in detail, seeks at least to give a summary impression of this order of nature, which is both an order of objective phenomena and a corresponding order of the sciences which give us the truth about these phenomena. It seeks to do justice, also, to the continuity of nature on the one side, and, on the other side, to the broad qualitative differences which we find within it, and which appear to demand an ascending, or, at least, a cumulative arrangement.

Within this universe of discourse, then, of biology expanded into the problem of the order of nature, the formula "not mechanism *or* vitalism, but mechanism *and* teleology" is to be interpreted. It means that we ought to replace the disjunction of mechanism and vitalism as mutually exclusive alternatives by the conjunction of mechanism and teleology. It demands that these concepts be treated as cumulative in the order of nature, and, therefore, teleology as *logically dominant* over mechanism in biology. So far as I can judge, the arguments against vitalism are decisive, if by 'vitalism' we mean the theory that in all the things called 'living' there is present some non-mechanical, non-spatial, semi-psychical force or factor—whether biotic energy, or entelechy, or *élan vital*—which yet has the power to interfere by way of regulation or control with the physico-chemical processes in the body; which can suspend the second law of thermodynamics; which can select for realization one of the physically open possibilities; which can create novelties, not

only unpredictable in advance but inexplicable after they have occurred. Vitalism in this sense I do not want to save, and this is the sort of vitalism between which and mechanism the choice for biology is usually said to lie. But whilst it is part of my thesis to reject vitalism on its merits, it is also part of it to reject the whole disjunction of vitalism and mechanism, acceptance of which would commit us to the affirmation of mechanism by the denial of vitalism. It is here that the second half of my thesis, "mechanism *and* teleology," comes into play. This is intended to give full scope to mechanistic theory to carry us as far as it can, but it is also intended to maintain that there is a sound sense in which it is true to say that the phenomena of life cannot be explained, or, better, formulated, in physico-chemical terms. Or, to put the positive side of the contention, teleological terms are required, not as substitutes for physico-chemical terms, but as fixing what I call the 'dominant' character of life-processes to which their physico-chemical aspect is subsidiary. The relation is easier to illustrate than to put into words. We find it, so it seems to me, wherever in nature there appears a new stratum or level, a new type of quality, or of structure. In the theory of colors, *e. g.*, or of sounds, the 'dominant' concepts are derived from an analysis of colors and sounds themselves—colors as such, or as actually seen, sounds as such, or as actually heard—and it is only the ordering of these data in terms drawn from their own nature that gives relevance to the subsequent correlation of color-differences or sound-differences with difference in the rate of vibration of some elastic medium. So, again, the dominant concepts of chemistry are patently derived from a study of the properties and states of elements and compounds in their relations to one another under varying conditions of temperature, presence of catalytic agents, etc. And it is not as a substitute for, but as a supplement, that we seek to correlate these facts and their laws with facts and laws of the physical structure and relations of atoms or whatever the ultimate constituents of matter may be. So with the phenomena of life. The dominant concepts required for an adequate theory of them are, on the view here maintained, teleological, but this

involves no denial of their physico-chemical aspect, or of the importance of discovering the physico-chemical arrangements and processes on which teleological characters and relationships are built. To forestall misapprehension, however, I ought to say at once that, when I speak of teleological concepts, I do not mean a design, or plan, or purpose, or desire consciously entertained by any mind, be it of God, of man, of animal, or of plant. We need teleological concepts freed of these implications; concepts so general that conscious designs or desires are but a special type falling under them. The way seems to me opened here by the concept of *value*, the introduction of which permits us to read relations of cause and effect as also relations of means to ends. The one reading belongs to mechanism, the other to teleology. The two readings do not exclude each other but are compatible, and, where the teleological reading is possible at all, cumulative. Life requires both readings, but the teleological reading must be dominant. This is my thesis.

3. One of the corollaries of this thesis is the 'autonomy of life,' or to put the same point from a different side, the autonomy of biology. Now, in one sense this is, of course, a truism, which no one, when the point is put up to him, seriously wants to deny, and to insist upon which, therefore, may seem a work of supererogation. Thus a convinced anti-vitalist, like Claude Bernard, is found writing:

"Je serais d'accord avec les vitalistes s'ils voulaient simplement reconnaître que les êtres vivants présentent des phénomènes qui ne se retrouvent pas dans la nature brute, et qui, par conséquent, leur sont spéciaux. J'admets en effect que les manifestations vitales ne sauraient être élucidées par les seuls phénomènes physico-chimiques connu dans la matière brute . . . La biologie doit prendre aux sciences physico-chimiques la méthode expérimentale, mais garder ses phénomènes spéciaux et ses lois propres."[1]

The same autonomy obviously can, and ought to, be claimed

[1] *Introduction à l'étude de la Médicine Expérimentale* (1865), p. 118. For a similar statement, see H. S. Jennings, *Am. Journal of Psychology*, 1910, pp. 349–370. For A. O. Lovejoy's comments see *Science*, N.S., Vol. XXXIV, No. 864, pp. 75–80 (July 1911), and his paper on "The Unity of Science" in the *University of Missouri Bulletin* (1912), Vol. I, No. 1, esp. pp. 22 ff.

by every science for itself and for the field of phenomena which it studies. So much seems to me rightly implied in our 'Basis of Reference.' All the differences which experience reveals in the world are, in this sense, unique, specific, *sui generis*. Why, then, is it worth while insisting on such a truism? Because there is a noticeable tendency in many quarters to deny it, in effect, by the way in which the ideal of a 'unified' theory of nature is interpreted. This interpretation constantly takes the form of claiming to 'reduce' one type of phenomena to another, of treating one as *nothing but* another. Life, *e. g.*, we find it said, is 'merely' a particular kind of physico-chemical process. Interpreted as a denial of vital force or entelechy, the statement is harmless enough. But it is harmful, or at least dangerous, in so far as the unique and distinctive character of life-processes is left completely unspecified and undetermined in this sweeping assimilation of them to physico-chemical processes in general. If we ask, *What particular kind* of physico-chemical process? it becomes clear at once that physico-chemical terms are not sufficiently specific and relevant for the answer required. In view of this situation it is of the utmost importance to insist that the attempt to eliminate differences, to break down boundaries, to unify by the 'nothing but' device, makes, not for orderly, but for disorderly thinking and does a disservice to science. The phenomena of life require to be dealt with first and foremost in their own teleological terms, and this not as a mere convenience of provisional 'description,' but as a necessity of adequate 'explanation,' or, better, of *understanding*.

The principle of the autonomy of life, then, means the right to use in biology teleological concepts. That biologists constantly *do* use such concepts, is too familiar a fact to require illustration. Some frankly confess that they cannot help using them. Others are apologetic about them, as if they were a temporary makeshift pending the formulation of an 'explanation' in physico-chemical terms. The thesis here maintained is that the use of teleological terms is not a symptom of relative ignorance. It is not a sign of the inferiority of biology to physics and chemistry. The principle of the autonomy of life should be for

biologists a charter of emancipation from the false fashion which leads some thus to depreciate their science. It should be a watchword reminding them to have the courage of their practice, and to insist on their right to use the language demanded by the facts with which they deal. That those who are really consistent in eliminating all teleological concepts from their thought and from their language—and this is patently the ideal which some 'mechanists' strive to realize—are compelled to misconceive and misdescribe the facts, can, I think, be shown. As an example of the kind of argument which brings this point home to one, I would like to refer to the criticism in E. B. Holt's *Freudian Wish*,[1] of the biologists who, in their anxiety not to compromise themselves with animal souls, analyze, *e. g.*, a bee's behavior into successive responses to visual, auditory, olfactory, etc., stimuli, and over it all lose sight of the *bee* and of the dominant fact that "the bee is carrying honey to its home." It is noticeable that the analysis of Bethe's which Holt here criticizes is itself still far removed from using strictly physico-chemical terms. Suppose, then, we push the issue back to the point to which a convinced mechanist must want to push it. Is not, let us ask, the bee's flight a case of the motion of a material body, and must it not as such conform to the laws which physics has formulated for matter in motion? Of course it is, and we may readily grant that, even though the flight of a bee, or the antics of a monkey in his cage,[2] or the behavior of any other living thing have not yet been formulated in terms of mechanism, yet 'in theory' this can be done. The reason why it has not at present been done lies in the exceeding complexity of the phenomena, not in any inapplicability of the laws of matter in motion owing to their being suspended, or interfered with, by some vital force. The important point is: supposing it were done, would it be relevant? Would it really explain, *i. e.*, give us a fuller insight into, what the bee is doing and why, than the account in teleological terms that it is laying by honey in its home? The moral of these considerations is that biology not only does, but may, not only may, but must,

[1] P. 77.

[2] See A. O. Lovejoy, *Unity of Science*, *l. c.*, p. 16.

use teleological concepts, and use them, moreover, as logically dominant over all other concepts which for subsidiary use it may borrow from other sciences. That all living beings, or, better, living bodies, are physico-chemical systems is here conceded and, indeed, insisted upon as much as the most whole-hearted mechanist can desire. But what I would also insist upon is that when we study living beings exclusively from the physico-chemical point of view, their character as *living* does not come within our field of study at all. From that point of view the difference between living and non-living is simply irrelevant. So far from being explained, it is rather ignored. It is not part of the physicist's or chemist's universe of discourse. Witness the transformation of the meaning of 'organic' in the chemist's language. The term there has lost the exclusive reference to the living which it retains in the biologist's mouth, and applies for the chemist to all carbon-compounds whatsoever, regardless of whether they are found or produced in the living or in the non-living. This, surely, is instructive. And the moral of it is that the biologist who knows his business will not try to 'reduce' himself to a species of chemist. Indeed, it is only on condition of his keeping his teleological categories dominant, that the investigation of the chemistry of vital processes becomes for him relevant and significant. He must first recognize a living thing or a living process *as such*, before the study of its chemical side or basis becomes important for him as throwing further light on his topic. In short, if our topic is carbon-compounds, life and the concepts it involves are irrelevant to us. But if our topic is life, then the laws of carbon-compounds, so far as these occur in vital structures and processes, are relevant, not because they reveal to us, as it is sometimes said, the 'secret' of life, but because a knowledge of the chemical processes involved in life (or, put differently, of the chemical bases or conditions of life) is part, but not the whole, of an adequate knowledge of life. Nor is biology in any way inferior to chemistry and physics, because it uses them ('depends' upon them, as it is sometimes ambiguously expressed), so far as they are relevant for its purposes. Its cognitive interest is centered, first and last, upon the study of living beings, their struc-

ture, their growth, their behavior. Their characteristic nature as *living* clamors for recognition in specific concepts. This is the situation to which the vitalist has the merit of calling attention, though he misinterprets it when he invokes entelechies or what not. This, again, is the situation which gives rise to the familiar assertion that 'no physico-chemical explanation of life is possible.' Such an explanation is impossible, not because of the operation of a vital force, but because, however detailed and complete in itself, it would neccessarily fail to touch the specific character of vital phenomena. To repeat: the principle of the autonomy of life, as here interpreted, means, not vitalism, but teleology—and teleology as compatible with, but logically dominant over, mechanism in biology.

4. This thesis may be challenged on the ground that it conflicts with the aspiration of science to achieve such an organization of knowledge as shall enable it to *deduce* vital phenomena from physico-chemical phenomena. Very commonly in recent literature this ability to deduce is identified with an ability to *predict*, and neither is held to be possible except on the basis of a mechanistic theory of nature. In fact, the *reduction* of organic processes to inorganic processes is, according to this view, undertaken chiefly in the hope that it will enable us from purely physico-chemical data to deduce, *i. e.*, to predict, vital phenomena, say the behavior of an animal in a definite situation. Thus Wilhelm Roux, in his *Entwickelungsmechanik*, formulates the mechanistic programme in the words, "*Das organische Geschehen auf anorganische Wirkungsweisen zurückzuführen, es in solche Wirkungsweisen zu zerlegen, zu analysieren.*" So keen a student of mechanistic and vitalistic theories as A.O. Lovejoy expands this formula as follows: "In what would a *Zurückführung* of biology to chemistry or physics consist? It would consist in showing that a given organic process A can be subsumed under and *deduced from* a given generalization B of the more "fundamental science."[1] In another paper this is further expanded as follows: "What the partisans of the doctrine of organic autonomy deny is that you conceivably ever can, from a study of the laws

[1] *Science*, N. S., Vol. XXXIII, No. 851, p. 611.

of motion of inorganic particles, arrive at a law from which you can predict how any living body will behave, *even if you know the number, size, arrangement and composition of the particles composing that body.*"[1]

Before passing to the particular issue of the predictability of organic phenomena, it may be as well to say something about prediction in general, to which, so it seems to me, an altogether exaggerated importance is assigned in modern theories of the function of science. Claude Bernard had a sounder view. "*Toute la philosophie naturelle*," he writes, "*se résume en cela: Connaître la loi des phénomènes. Tout le problème expérimental se réduit à ceci: Prévoir et diriger les phénomènes.*"[2] This distinction is surely well taken. It is a valuable corrective of the fashionable view which makes prediction the main interest and business of science, and treats the discovery of laws as nothing more than a means to prediction. Indeed, I would go even further here than Claude Bernard, and regard prediction, not as a co-ordinate aim of science but as incidental to the experimental discovery of laws (in the process of verifying hypotheses) and as dominant only in the practical application of scientific knowledge in industry. From this point of view it is a mistake when the typical formula for a scientific law:—If A, then B, is read off as essentially a prediction:—If A happens, then B will happen; or, If you do A, then you will get B. Fundamentally, a law is a statement of a functional correlation between variables. 'If A, then B' means 'A implies B,' and there is no exclusive or essential reference in this formula to the anticipation of future events. It would, moreover, be wholly false to restrict science to a preoccupation with the future. Science is as much interested in the past as in the future, and its problems as often take the form of discovering the causes of given effects, as of predicting the effects of given causes. And, lastly, the treatment of an implication as a prediction is false, not only to the character of an implication, but also to the character of a prediction. Prediction, in the proper sense, is not hypothetical, but *categorical.*

[1] *Science*, N. S., Vol. XXXIV, No. 864, p. 78. Lovejoy's italics.

[2] *Introduction à l'étude de la Médicine Expérimentale*, p. 100.

You do not predict so long as you merely say, *If A*, then *B*. But you do predict when you say, Here is an *A*, and in virtue of the law, If *A*, then *B*, I infer that there will be a *B*. A law, in short, is not a prediction, but may make a prediction possible when applied to a particular case, or to put it differently, when a definite value is given for one of the correlated variables. And even then the correlation must be of the kind which involves temporal sequence or order.

Prediction, then, is by no means identical with deduction in general. It is a special case of deduction, possible only under special conditions. Moreover, it owes its prominence in the discussion of mechanism and vitalism to the fact that the relation of biology to physics and chemistry, or of organic to inorganic processes, is usually conceived, not merely as one of reduction, *i. e.*, of subsumption of particular under general, but as an *evolutionary* and, therefore, *temporal* sequence. In this context we get the problem of the origin of life, in the form whether from physico-chemical data alone a Laplacean calculator could have deduced, *i. e.*, predicted, the future appearance upon this earth of living beings. Or, more narrowly, could such a calculator, given an exhaustive knowledge of the particles and forces involved in the present position of my body in its environment, predict my next movement?[1]

Let me make the question even more precise by restricting it to the law of falling bodies, and giving it the form of an imaginary experiment. Compare the fall, through the same distance of space and under the same atmospheric conditions, of two bodies which differ only in that the one is lifeless, the other living, whilst they are alike in weight, shape, surface-texture, and any other factors which affect the rate of fall. Do you, as physicist, expect to find any difference in the rate at which the falling body in each case traverses the distance to the ground? If you find no difference in this respect, is the difference between being

[1] I agree whole-heartedly with the remarks of H. S. Jennings concerning predictability in his paper "Life and Matter," originally written for the fifth International Congress of Philosophy which, owing to the war, was never held. The paper will be found in the *Johns Hopkins University Circular*, N. S., 1914, No. 10. The reference is to p. 11.

lifeless and alive relevant to you, as a physicist, at all? It will not be part of the data which make the falling body a 'case' of your laws. Hence your laws are indifferent, or neutral, to that difference. They hold equally in either case. A living cat does not infringe or violate them. It does not fall slower or faster than a dead one. Yet there is a difference, as we all know, not in the rate of fall, but in the turnings by which the live cat lands on its feet and breaks the fall, escaping injury and death, whereas the impact of the dead cat involves contusions of the body and broken bones. The point of the argument, if there is anything in it, is simply this, that the physicist's data and laws abstract from certain differences, which consequently can neither be subsumed under his laws nor predicted from them alone.[1]

The conclusion which I would draw is that considerations of this sort support my previous contention. The biologist is interested in the study of living things, and hence finds it convenient to divide all things in nature into those which are living and those which are non-living.[2] The inclusion in his field of

[1] Mention of 'lifeless,' in the sense of 'dead,' bodies suggests a curious point, about the exact bearing of which I am neither clear myself, nor are, so far as I can find, my biological authorities. If we dichotomize bodies into living and non-living, organic and inorganic, where do we put the bodies which are dead in the sense of having lost their life, of having been alive and having died? Does an animal or a plant by dying pass straightway into the same class with bodies that are lifeless in the sense that neither life nor death can be predicated of them? In short, death seems to fit awkwardly into the tidy classification of organic and inorganic. The point has interesting ramifications. The biologist, in effect, ceases to be interested in an animal when it has died. It has ceased to 'behave' and to 'respond'; its organs have ceased to function; the phenomena of regulation, so important in the economy of life, no longer appear. Yet would a physiologist necessarily agree to draw the line there? I recall being shown as a student an elaborate and expensive apparatus in the Physiological Laboratory at Oxford, used for experiments upon eyes taken from dead frogs, the result being interpreted as bearing on the question whether black is a positive sensation. It seemed to me humorous, but mechanists may think the joke is on me.—If we look in another direction, we find in the economy of nature, that dead organisms play an immensely important part as food for organisms which are alive. Is not breathing almost the only exception to the rule that, above the level of plants, living things absorb inorganic substances only indirectly by inflicting death on other living things or living on things that have died? And to a large extent this is true even of plants.

[2] It is perhaps not an unnecessary reminder, at least to those of us who are unfamiliar with biology, but familiar with the history of philosophical terms, that when biologists use 'animate' as a synonym of living or organic, and 'inanimate'

study of some things, the exclusion from it of others, depend upon the presence or absence of the distinctive quality or character which we call 'life,' and which is empirically observable and recognizable. The physicist and the chemist are not interested in this character, and its presence or absence is irrelevant to them. Hence to them living bodies as much as lifeless bodies are physico-chemical systems. But the biologist's interest in life makes him interested also in the physico-chemical structures and processes without which life is not found in our world. Hence his point of view, in this respect, may be called synthetic or synoptic. In any case, if our universe is to be intellectually tidy and ordered, we need both points of view as cumulative and supplementary, viz., the point of view from which all bodies are physico-chemical systems, and the point of view from which some are living and others are not. There is, if we like to put it so, homogeneity and continuity from one point of view, heterogeneity and discontinuity from the other. But nothing is gained by ignoring one of these two sides.

5. But this, it may be said, is incompatible with the unity of science, which requires a determinism in homogeneous terms, such as can be supplied only by a mechanistic theory, *i. e.*, a theory by which all qualitative differences are reduced to, and explained in, terms of one kind only, and these ultimately the terms of physics. The admission of non-mechanistic concepts would destroy the determinism which is essential to science in general and to experimentation in particular.

The reply to this objection is, briefly, that my thesis not only does not involve the surrender of determinism, rightly interpreted, but meets all the logical requirements of the situation. The main points may be summarized as follows. (*a*) In the first place, we ought to distinguish between determinism and mechanism. The determinism which is identical with 'reason' in science, and without which any 'rational' explanation of natural phenomena is rightly said to be impossible, requires merely that every such phenomenon shall be 'determined by'

as a synonym of non-living or inorganic, they do not identify life with the presence of an *anima* or soul. They ring the changes on these terms simply to avoid monotony of style.

some other phenomenon, *i. e.*, correlated with it according to a law. A mechanistic theory is but a special form of this general principle of determinism, deriving its specific character partly from the introduction of a temporal factor (cause preceding effect), but more characteristically from the exclusive use of "geometrical, kinematical, mechanical, and physico-chemical terms," as stated in the 'Basis of Reference.' (*b*) Every law is a statement of an implication between universals, or, in mathematical terminology, of a functional correlation between variables. In the natural sciences which deal with existences in time and space, presented or presentable in the form of sense-data, all universals have cases, or instances, or applications; all variables have definite values. (*c*) But a unified theory of nature does not require the reduction of all universals to one kind, or the restriction of all variables to one type of values. We have laws correlating geometrical, physical, chemical phenomena among themselves in each group, as well as laws correlating phenomena of one group with those of another. There will then result a scheme, or an order, in which differences are preserved, and not 'reduced,' and in which a unified theory is achieved by the correlation of different types or groups or levels of phenomena which follow also among themselves each its own characteristic laws. (*d*) We shall thus expect to find what, indeed, we actually get in a large part of biological work, viz., a determinism in terms which are thoroughly teleological. Such a determinism will meet all the requirements of what H. S. Jennings pleads for under the names of "experimental determinism" or "radically experimental analysis." One might formulate the principle of determinism as 'every difference makes a difference.' This is nothing but functional correlation expressed in other words. For, when two factors are correlated, a change in one must involve a corresponding change in the other—'corresponding,' whether or no the variations on both sides are measurable and quantitatively determinable. In scientific observation the rule of method is, given an observed difference A to search for some other observable difference B, such that A is present where B is present, absent when B is absent, and varies

concomitantly with the variations of *B*. This is the elementary ABC of induction. Experimentation applies the same principle by artificially introducing, removing, or varying *B* so as to study its correlation with *A*. As H. S. Jennings says—in complete accord with the teachings of logicians on this point—the whole "organization" of experience by "discovery of correspondence in diversities" depends on this principle.[1] (*e*) The only point of refinement which this paper may, perhaps, claim to add to the above account is the insistence on what I have ventured to call the 'logical dominance' of the characteristic concepts and laws of biology on the ground that biology deals with structures and processes which have, indeed, their physico-chemical aspect, but cannot be reduced to exclusively physico-chemical terms without sacrificing precisely what makes them distinctive.

6. It remains to say a few words in defence of teleology and of the language of 'purpose,' by ridding the latter term of certain associations, the presence of which makes it unwelcome to scientists, and which are not required by the facts.

'Purpose' is objectionable, because it suggests the activity of a scheming or designing intelligence where no evidence of such is found. To talk of purposes in nature at once gives rise to the suspicion that their admission is to be exploited, as in the old Argument from Design, in the interests of an anthropomorphic deity; that intelligible law is to be replaced by an unintelligible will. But our plea here is that the terms can be freed from these implications and made scientifically useful. A transition can be made from 'efficient' to 'final' causes by the simple reminder that a nexus of cause and effect can *also* be taken as a nexus of means and end, whenever the effect has *value*. A natural law, in the sense explained in the last section, neither demands nor forbids the introduction of the concept of value, and is, therefore, entirely compatible with it, if the empirical facts should demand it. Some modern writers, indeed, would limit the application of the concept of value to whatever is desired. Things, they say,

[1] *Life and Matter*, p. 6 *et passim*. *Cf.* also the general position outlined there on pp. 10–11.

become valuable, or acquire value, by being desired. But, again, it is not in this sense that the term 'value' is to be employed here. When biological science speaks of conditions as 'beneficial' or 'harmful' for the organism; when it calls some chemical substances 'foods,' others 'waste-products'; when it speaks of the 'function' of an organ, or through the concept of 'organization' interprets the parts in the light of the whole; when, in dealing with 'growth,' 'behavior,' 'reproduction,' etc., it applies the concept of the maintenance or development of each characteristic type of living structure—its language is full of the kind of teleology which the term 'value,' or, if it be preferred, 'objective value,' is here intended to cover. Wherever, broadly speaking, the facts challenge us to say, not merely that *B* is the effect of *A*, but that *B* is the *reason why*, or *that for the sake of which*, A exists or occurs, there we have the *immanent purposiveness* of living things. To introduce here the analogy of human purposes, *i. e.*, to suppose the existence of these structures, the occurrence of these activities and functionings, to have been preceded by a desire for their existence or occurrence, or by a conscious design, plan, scheme, first thought out and then realized by the manipulation of means, would be misleading and irrelevant. No living thing begins by planning or desiring its own existence, its own form and function. No organism grows and lives according to a preconceived specification, building up its body like a builder working to a design, or like a tailor working to a pattern. 'No living thing' we said. And this covers not only plants and animals, but man. For, though we claim each to be 'master of his fate,' yet for all the planning that we do, for all the efforts that we make to guide ourselves and our world towards desired results, we tend vastly to overrate the part that desiring and scheming play in making us and our world what they are. Conscious choice, intelligent control, art, masks, but does not displace, the immanent and unconscious purposiveness which the lives of individuals and societies exhibit, and which is discernible even through their misfits and failures.

When we ask what character in natural objects, or in nature as a whole, exhibits this immanent purposiveness, this 'design,'

most clearly, the answer must surely be that it is *organization*—not merely in the static sense of a systematic structure of differentiated parts, but in the dynamic sense of this organization at work and functioning as a whole, responding through its organs (which are very literally 'instruments') to its environment, adapting that environment to itself and itself to it. A purposive structure, in Kant's famous phrase, is one in which parts and whole are reciprocally means and ends. The subordination of the parts to the whole lies precisely in that delicate mutual adjustment of the parts which, in respect of their functioning, we call *regulative*, and which in form as well as in function yields the characteristic individuality—one might almost say, using the word in the artistic sense, 'the effect'—of each living thing. Aristotle went straight to the heart of the matter when he compared this organization of each living thing to the order of a commonwealth. "And the animal organisms must be conceived after the similitude of a well-governed commonwealth. When order is once established in it, there is no more need of a separate monarch to preside over each several task. The individuals each play their assigned part as it is ordered, and one thing follows another in its accustomed order. So in animals there is the same orderliness—nature taking the place of custom and each part naturally doing its work as nature has composed them."[1] We have here clearly what in the language of modern biology is expressed as "the conception of the living thing as an autonomous unit in which every part is functionally related to every other and exists as the servant of the whole."[2]

And yet living beings are also constantly spoken of as 'living machines' and their organs as 'mechanisms' for doing this or that. Whence it is a short step to the demand for an exclusively 'mechanical' explanation. But a brief reflection on the concept of a machine will both account for the plausibility of this language and yet lend support to our view. It is surely a startling paradox that machines, which, as human tools for human ends, are more

[1] Henderson has done a real service in reminding us of this passage in his *Order of Nature*, p. 10.

[2] Henderson, *ibid.*, p. 21. 'Functionally related' in this context bears, I take it, both the mathematical sense given to it in section (4) and the teleological sense of this section. The two senses correspond to cause-effect, means-end respectively.

patently purposive than anything else in the world, being artefacts of human design, should have furnished by analogy the concepts which are used to shut out from the purview of science, not merely conscious design, but the immanent purposiveness exhibited in organization and regulation. Yet a machine is nothing if not organized, and frequently it is fitted with devices for regulating its own workings. It is, in fact, like an organism, a systematic structure of differentiated parts with differentiated functions. It was this uncanny likeness of machines to organisms which suggested Samuel Butler's brilliant fancy, in *Erewhon*, of a revolt of machines against man, their maker, the intelligence embodied in them making itself, as it were, independent. What is it that enables science to borrow from so purposeful and highly organized a thing as a machine the concepts for dealing with the non-purposive and inorganic? The answer would seem to be this. A machine, just because as a human tool it exists, not for its own sake, but for the sake of something other than itself, makes it easy to abstract from its purpose and to consider its organized structure as simply a system of particles and forces, undergoing transformations according to purely physical laws. A physicist, whom we will suppose ignorant of the purpose of a watch, might still be able to analyze it as a mechanism and to explain just why this intricate arrangement of toothed wheels and other devices, operated by a spring, must effect the rotation of two hands, each at its own uniform speed, but one twelve times as fast as the other. So far the mechanistic point of view, with its cause-effect principle, might carry him, nor need he know the end to which the whole arrangement is means. Now if it is easy to analyze a machine which has a purpose as if it had none, because its purpose is 'external' to its own existence, it is even easier to ignore the immanent purposiveness of an organism, which is not obviously an instrument for anything. Thus, by a similar abstraction from their teleological character, organism and machine can be analyzed, as if neither exhibited any characters except those of which we take account when we study them as physico-chemical systems.

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DISCUSSION.

The Kantian Ethics and its Critics.

In his recent book, *An Ethical Philosophy of Life*, a review of which appears in this number of the *Review*, Professor Adler offers a number of criticisms of the Kantian principles of ethics which do not seem to me to do full justice to that much praised and much abused theory of morality. They are not new, and they are not wholly without foundation, but, in my opinion, they reach the letter rather than the spirit of the teaching, and therefore tend to hide what is really fruitful in it and in harmony with modern idealistic ethics. Perhaps I may be able to show that this is so in what follows.

Professor Adler finds that both the foundations and some of the consequences of the Kantian doctrine are unsound. Kant, he declares, "has nowhere given us reason to believe that the acceptance of an absolute end is implied in the kind of constraints to which the generality of mankind submit. And again if such acceptance cannot be proved, then the universal moral equality of men based by him on the presence in all of the sense of duty disappears, and his lofty ethical structure breaks down at this point" (pp. 80f.). It seems to be forgotten here that Kant sought the supreme ethical principle in the moral *judgments* of commonsense, and, having found it, described its characteristics and inquired into its presuppositions: the categorical imperative legislates universally; morality is always disinterested; it is rooted in respect for man; it implies the intrinsic worth of the human individual and a kingdom of ends, or a spiritual society of rational beings in which truth and justice and mercy shall reign. Like Professor Adler he declares that "morality is either universal or nothing." As in Professor Adler's system the category of worth is fundamental. It is true, as the critic holds, that the savage is unaware of such a lofty imperative and its implications, but it is equally true that the savage gives no evidence of attributing worth to Professor Adler's unique personalities. That does not affect the *rationality* of the principle in either case. Kant sets up what he conceives to be a *rational* standard of life, which finally turns out to be an ideal of worth. Professor Adler holds that there are no sure signs that men have such motives as Kant demands or that they act in accordance with them, and that is exactly what Kant himself maintains: we can

never be sure that the agent's motives are pure, but the act cannot be called moral unless the motives *are* pure, unless the man is holy.

Professor Adler insists that Kant's ethical principle is a physical principle in disguise on the ground that if an act can be universalized, the performance of it is morally necessary. This is not Kant's meaning. He knows that a universal law of nature could indeed exist in accordance with his maxim, but he holds—and it is important to remember this,—that it would be impossible to *will* that such a principle *ought* to exist as a law of nature. (See *Grundlegung*, Rosenkranz edition, vol. viii, p. 50.) Besides, Professor Adler takes literally what is intended merely as an analogy. He regards as conclusive that Kant derived his ethical principle from his physics the fact that he speaks of the ethical order as a universal and necessary order like that of nature (p. 88). Now it is true that if Kant had meant by his ideal society of ends an order wholly like the physical order, determined by the law of causality, the moral order would not have a dignity superior to that of the physical order. But how can we identify an ideal society of free spirits who are conceived as acting in accordance with rational ethical principles or Ideas, with such an order? "It is permissible," says Kant, " to employ *the nature of the world of sense* as a *type* of an *intelligible nature*"; the law of nature serves as an analogue to the law of freedom or a supersensible system of things. (See *Kritik der praktischen Vernunft*, *ib.*, pp. 156ff., 193.) "There is a difference between the laws of a nature to which *the will is subject*, and of a *nature which is subject to a will* (so far as its relation to its free actions is concerned); and this difference is based on this: that in the former case the objects must be the causes of the ideas, which determine the will, while in the latter the will is to be the cause of the objects, so that the causality of this will has its ground solely in a pure faculty of reason, which may, therefore also be called a pure practical reason" (*ib.*, p. 159). Accordingly in maintaining that the method of ethics must be the opposite of that of physics Professor Adler has no ground of quarrel with the real Kant. Kant does not base his ethics on physics.

Professor Adler holds that ethics cannot take a step without an ideal of the whole, and he thinks that Kant "aimed to vindicate the certainty of the physical knowledge of a part as being compatible with total ignorance of the whole" (p. 94). This is true, but it is true in a sense which does not justify our author's criticism of Kant. Kant's object was to understand the presuppositions of the science of physics: how is a universal and necessary knowledge of nature possible,

the kind we have in the Newtonian physics? His conclusion is that we have here only a surface-knowledge, a knowledge that deals with perceptions, a knowledge of phenomena, and that we could not even have certain knowledge of *phenomena* if it were not for the forms of the mind: we know the forms of the phenomenal world only because we impose them upon the world of sense. The Newtonian physics is not real knowledge, a knowledge of the essence of things. But we do have real knowledge in ethics; the moral law, which is a law of reason, guarantees the reality of a spiritual or noumenal order. It is true, as Professor Adler declares, that Kant opposed pure rationalism when he expelled the older metaphysics. But it is true only in part: he expelled the old *apriori* metaphysics which tried to penetrate to the heart of things through the phenomenal world and applied the scientific categories to things-in-themselves. But he was no more an agnostic than was Descartes; he demolished the old-fashioned proofs for the existence of God, freedom, and immortality to make room for faith in the same old realities. And he tried to give us more than a faith; on the basis of the moral law, which, in the *Critique of Practical Reason*, he called a *factum* of reason, an unexplainable truth, he attempted to demonstrate the reality of the spiritual world together with everything that he thought necessarily went with it. He was too rationalistic to seek refuge in "intellectual intuitions," in mysticism and *Schwärmerei*, or in pragmatism; the categorical imperative is for him a deliverance of reason of such convincing certainty as to form the basis of a new philosophical structure. His new arguments for the old truths are weak, but that is not the question. The fact remains that Professor Adler too reaches the spiritual world by way of ethical principles; he too rears a metaphysical system upon the moral law; for him too there is something in morality that stands firm in the breakdown of worlds.

In declaring, as he does later on, that Kant substitutes a logical necessity for a physical necessity, Professor Adler seems to me to destroy his original argument. If he is right, then Kant's ethical principle is not "a physical principle in disguise," but a logical principle in disguise. In truth, it is neither the one nor the other. It is an ethical principle, sometimes supported by a logical principle, which in its application to concrete acts quite properly appeals to logic. A rational will cannot will that what is wrong for others should be right for itself; in certain cases, however, a motive if made universal (for example, the breaking of a promise from selfishness) would, in addition, defeat itself (bring about universal distrust in promises) and

involve the agent in a logical contradiction. Kant says on this point: "We must be able to will that a maxim of our conduct become a universal law: that is the canon of moral judgment in general. Some acts are so constituted that their maxim cannot even be *conceived* as a universal law of nature without contradiction; far from our being able to *will* that it *shall* become such a law." (*Grundlegung, ib.*, p. 50.)

In this connection another very important fact must be borne in mind: Kant regards as one of the implications of his imperative the notion of the worth of the human personality: Act so as to treat humanity, whether in thine own person or in the person of any one else, always at the same time as an end, never merely as a means. More than that: he regards this respect for humanity as the rational basis upon which the imperative rests. It is only when we forget this and exaggerate the part which the notion of selfconsistency plays in Kant that we can say with Professor Adler that "the notion of end is incompatible with selfconsistency as the paramount principle in ethics"; that "if we take as our principle respect for the abstract notion of universality and necessity based on universality, we must abandon the idea of man as end in himself"; that "necessity to Kant means unity of a thing with itself"; and that "rational selfpreservation therefore is the only character that can be predicated of any of the entities composing the society of ends: they are selfsufficing and moreover intrinsically unrelated to each other" (p. 88). The truth is that respect for humanity, and not logical consistency, forms the backbone of the categorical imperative, and that Kant never lost sight of the ideal of a society of ends, of a society of rational beings, every one of whom must act in such a way as to make that society possible, that is, from disinterested, universal motives. There is no incompatibility between the notion of end and selfconsistency in Kant for the simple reason that selfconsistency is not the paramount principle in his ethics.

Professor Adler offers the further objection that Kant proclaims man as end *per se*, that this promises a philosophical basis for an ethical world-view, but that the promise is not kept because he starts from absolute obligation and attempts to deduce from an empty formula a worthwhile object (p. 100). This criticism forgets that Kant tries to deduce the categorical imperative itself from the notion of the will of a rational being and finds that if there is to be such a categorical imperative, it must be founded on the principle that rational nature exists as an end *per se*, that man as a rational being has absolute worth, or, as Professor Adler would say, is a worthwhile object.

From this objective principle, Kant asserts, all the laws of the will are to be derived; which means that the imperatives are grounded in the notion of worth. (See *Grundlegung*, p. 55.) Professor Adler also declares that we cannot establish the conception of worth "unless we have some ideal of the whole in which and in relation to which the incomprehensible worthwhileness of a human being can be made good" (p. 103). "It is as an ethical unit, as a member of the infinite manifold that man has worth." It is in the conception of a unity in which "the unique differences of each shall be such as to render possible the correlative differences of all the rest" that we get our hand firmly on the notion of the right, and by means of it we discover the object which Kant failed to find, the object to which worth is attached" (p. 117). Now, it does not seem to me that Kant ever loses sight of the whole; it is implied in every formula of the moral law offered by him. He has the ideal of a society (*Reich*) of ends, a union of different rational beings or members, who will universally, disinterestedly, morally. "Morality therefore consists in the relation of all conduct to the legislation by which alone a kingdom of ends is possible." Kant's thought is that in order to act rightly I must conceive my fellows as equal members of a rational order, act as a legislating member of a society of ends, treat every man as an end *per se*. Professor Adler's teaching is that "I must help others in order to save myself; I must look upon the other as an ethical unit or moral being in order to become a moral being myself" (p. 121). Both thinkers conceive the individual as a member (Kant uses the term *Glied*) of a whole; the whole implies members, members imply a whole; we cannot attribute worth to the member without attributing worth to the whole, and *vice versa*. It is true that Professor Adler advances beyond the notion of a human social order and seeks to anchor morality in the infinite spiritual universe, but it is the conception of human worth that leads to the ideal of an infinite spiritual universe in his system, and not *vice versa*. It is because he sets a supreme value upon unique personalities that he demands a spiritual kingdom in which what is best in them shall be preserved; his metaphysics grows out of his ethics. In a certain sense it may be said that Kant's metaphysics also springs from his ethics: God, freedom, and immortality are postulates of the moral law.

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REVIEWS OF BOOKS.

An Ethical Philosophy of Life: Presented in its Main Outlines. By FELIX ADLER. New York, D. Appleton and Company, 1918.—pp. viii, 380.

This is the mature work of a man who has labored honestly and unceasingly to sound the depths of the moral life, who has faithfully served the nation as an ethical teacher, who has endeavored to make his faith a living practice and has succeeded, to some extent, in translating it into the body of our social existence. We have here not a closet-philosopher who constructs Utopias "under the shelter of a wall" nor a scorner of theory who follows the fads of the day, but a thinker who keeps his eye steadily fixed upon the world as it is and strives to discover what a "worth-producing" rational human being must will it to be. As Professor Adler himself says, the book "records a philosophy of life growing out of the experience of a lifetime." What it offers "is a system of thought and points of view as to conduct, as they have jointly grown out of personal experience." He does not presume to lay down the law for anyone; he finds that he can set forth the better standards which in the course of trial and error he has come to recognize. The volume gives us an insight into the evolution of a practical idealist in whom the deeply rooted ethical strain is supported always by a clear intelligence which seeks a rational justification of the faith that is in him, prevents him from ignoring the hard facts of life, and saves him from indulging in shallow and sentimental theorizing. Kant has had a telling influence upon him; in spite of his antagonism to the German whose disciple he remained for many years, his conception is essentially Kantian:[1] respect and reverence are writ large in his vocabulary; indeed, maudlin sentimentality is as distasteful to him as were the eighteenth century "volunteers of duty" to his former master. The holiness conception of Kant, Professor Adler tells us, formed the starting-point of his own system; he was attracted to him because he affirmed it, and he "broke with him because he does not make good his affirmation." And it was because of his never-changing faith in this ideal that he rejected Marxian socialism, with

[1] I refer the reader to the discussion in another part of the number in which I have endeavored to show that much of Professor Adler's opposition to Kant is based upon what seems to me to be a failure to do justice to that philosopher's basal thought.

which he had dallied for a while in his youth: "if there be no such thing as morality, or if morality be but an epiphenomenon of economic conditions, what warrant have the hungry or the disadvantaged for complaining?" (p. 46.) "I became convinced that the ethical principle must run like a golden thread through the whole of a man's life, in a word, that social reform unless inspired by the spiritual view of it, that is, unless it is made tributary to the spiritual, the total end of life, is not social reform in any true sense at all" (p. 56). It is due to the stern regard of their leader for reason and right, to his downright sanity, that the ethical societies which Professor Adler founded avoided the pitfalls into which they might easily have disappeared; that they never took the shadow for the substance is in large measure owing to his wise guidance, as is also the fact that the social movements which have quietly grown up in these societies have become established institutions throughout the land.

The fundamental fact in ethics for Professor Adler is the notion of worth. The quality of worth belongs to a particular kind of energy. "It is unlike the physical forces; it is not a transformed mode of mechanical energy. It is *sui generis*, underivative, unique; it is synonymous with the highest freedom; it is power raised to the N'th degree. It is ethical energy. To release it in oneself is to achieve unbounded expansion. Morality, as commonly understood, is a system of rules, chiefly repressive. Ethical energy, on the contrary, is determined by the very opposite tendency; a tendency, it is true, never more than tentatively effectuated under finite conditions. And because the energy is unique, it points toward a unique, irreducible, hence substantive entity in man, from which it springs. This entity is itself incognizable, yet the effect it produces requires that it be postulated. The category of substance, which is almost disappearing from science, is to be reinstalled in ethics. Ethics cannot dispense with it" (pp. 92f.).

But ethics cannot take a step without an ideal of the whole. "No detached thing has worth. No part of an incomplete system has worth." "We must possess an ideal plan of the whole if we are to be certain of our rightness in any particular part of conduct." "There is not a single partial rule of conduct, neither 'Thou shalt not kill' nor 'Thou shalt not lie,' nor any other that, taken by itself, is of itself ethically right. It may be right, it may be wrong. It takes its ethical quality from the plan of conduct as a whole, and without reference to the whole it is devoid of rightness." (See pages 98 and 99.) "Hence the conclusion that there is no possibility of establishing

the conception of worth unless we have some ideal of the whole in which and in relation to which the incomparable worthwhileness of a human being can be made good" (p. 103).

The language of the last quotation is ambiguous; it is open to the interpretation that the intrinsic worth of man cannot be established except by reference to a certain ideal of the whole, and that morality would have no foundation if there were no spiritual universe. All that Professor Adler shows, however, and perhaps means, is that a social whole is necessary in order that "worthwhile" personalities may be developed; and that our judgment of man's intrinsic worth demands such a universe. The great datum of ethics, he says, is that man is an end *per se*. Ethical theory must give an account of this. As possessing worth on his own account man is an ethical unit. Only as a member of the infinite spiritual universe does he possess the twofold attributes implied in worth—inviolability with respect to outsiders and indefeasible intrinsic preciousness (p. 125). The universe is the necessary postulate required if the idea of right is to have validity; the ethical manifold, the spiritual universe exists in so far as there is right (p. 126). The thought here seems to be that inviolability and intrinsic preciousness and the idea of right presuppose the notion and even the existence of a spiritual universe, an infinite system of interdependence in which men as ethical units have their place. Here we are reminded of Kant,—of his postulates of pure practical reason: the existence of God and the immortality of the soul;—he is a theist while in Professor Adler's system "the God-idea is replaced by that of a universe of spiritual beings interacting in infinite harmony" (p. 126). His philosophy is rooted in the faith of the worthwhileness of man; it is because he conceives the individual as precious that he demands an infinite whole in which that preciousness shall not be lost. Our belief in the good calls for a world in which that good shall be preserved. In the final, beautiful chapter of the book, "The Last Outlook on Life," we find this idea nobly expressed:

"The world as we know it is itself the veil, the screen, that shuts out the interplay, the weavings and the interweavings of the spiritual universe. But at least at one point, in the ethical experience of man, is the screen translucent. The plan of the spiritual relation is there traced in outline. It is this plan that conveys the certainty as to what verily exists beyond, within, beneath.

"As to my empirical self, I let go my hold on it. I see it perish with the same indifference which the materialist asserts, for whom

man is but a compound of physical matter and physical force. It is the real self, of which the empirical was the substratum, upon which I tighten my hold. I do not assert immortality, since immortality, like creation, is a bridge between the phenomenal and spiritual levels. Creation is the bridge at the beginning; immortality the bridge at the end. Were I able to build the bridge, I should know. I do not affirm immortality. I affirm the real and irreducible existence of the essential self. Or rather, as my last act, I affirm that the ideal of perfection which my mind inevitably conceives has its counterpart in the ultimate reality of things, is the truest reading of that reality whereof man is capable. I turn away from the thought of the self, even the essential self, as if that could be my chief concern, toward the vaster infinite whole in which the self is integrally preserved. I affirm that there verily is an eternal divine life, a best beyond the best I can think or imagine, in which all that is best in me, and best in those who are dear to me, is contained and continued. In this sense *I bless the universe. And to be able to bless the universe in one's last moments is the supreme prize which man can wrest from life's struggles, life's experience*" (pp. 359–60).

The worthwhileness of a human being can be made good only by the assurance that all that is best in him will somehow survive.

> Es kann die Spur von seinen Erdentagen
> Nicht in Aeonen untergehen.

There is another phase in our author's teaching that deserves attention. We have seen that he attributes worth to the personality, the unique, irreducible, substantive entity in man. In developing his theory, however, he introduces uniqueness of another kind, which he thinks differentiates his system from other idealistic philosophies. He expands his thought in the following formulas: "Act as a member of the ethical manifold (the infinite spiritual universe). Act so as to achieve uniqueness (complete individualization—the most completely individualized act is the most ethical). Act so as to elicit in another the distinctive, unique quality characteristic of him as a fellow-member of the infinite whole" (p. 117). Now "the actual unique quality in myself is incognizable, and only appears, so far as it does appear, in the effect produced by myself upon my fellows. Hence, to advance towards uniqueness I must project dynamically my most distinctive energy upon my fellow-members" (p. 118). "I must seek to elicit the consciousness of the uniqueness and the interrelation in others. I must help others in order to save myself; I must look upon the other as an ethical unit or moral being in order to become a moral being

myself. And wherever I find consciousness of relation, of connectedness, even incipient, I project myself upon that consciousness, with a view to awaking in it the consciousness of universal connectedness'' (p. 121).

The ideal is a society of unique personalities in which "the unique difference of each shall be such as to render possible the correlated unique differences of all the rest" (p. 116). Each infinitesimal member is indispensable, has worth; "a duplicate would be superfluous." Professor Adler's language often has an extremely individualistic ring: I must help others in order to save myself in the sense that I cannot achieve uniqueness without "injecting streams of dynamic energy" into my fellow-beings. One sometimes gets the impression that the universal order is a mere means of bringing out one's individual uniqueness, and that the chief end of man is to be different from everybody else. This, however, is not the real meaning of the theory. Since uniqueness has absolute ethical worth I must achieve it in myself; but I must also seek to elicit it in others, I must work to bring about an interrelated whole of unique beings, I must arouse the consciousness of such an ideal in others. "A virtuous act is one in which the ends of self and of the other are respected and promoted jointly" (p. 214). The difference in method which distinguishes his system from others, Professor Adler tells us, consists in the joint pursuit of the two ends, that of the other and that of the self (p. 220; see also pp. 148, 190, 222).

The system is no more *egoistic* than is Aristotle's, Kant's, or Green's. It is, however, *individualistic* in the sense that the object of highest worth is the unique individual. "The ethical quality is that quality in which a man is intrinsically unique" (p. 142). "The self is precious on its own account" (p. 214). We must learn to prize distinctive difference above uniformity or sameness. "I do not of course deny that there are certain uniformities, chiefly negative, in moral conduct, but I have come to think that the quality of moral acts consists in the points in which they differ rather than those in which they agree. The ideally ethical act, to my mind, is the most completely individualized act" (p. 24). The doctrine of uniqueness has been taught before, in various forms,—by the Greek Sophists, by the Romanticists, by Humboldt, Schleiermacher, Mill, Emerson, and others,—and it needs to be emphasized, particularly, perhaps, in a democracy, as a protest against the tendency to make everybody like everybody else. We are led to ask, however, whether mere difference has any more worth than mere sameness. There is a uniqueness, to be sure, which is indefeasible: each individual is a person, a self, an ego, a

ἅπαξ λεγόμενον, something that has never been before and will never be again. But not every difference in thought, feeling, and action has worth as such; we need a criterion by which to appraise uniqueness. Professor Adler himself says: "Difference in the ethical meaning is not to be confounded with mere idiosyncrasy, or originality, not to say eccentricity. It is the kind of difference which elicits correlated difference in all spiritual associates" (p. 142, note). Although this will not serve as a satisfactory principle of measurement, it points to an *ethical* standard of some kind. We can accept the statement: "That every man is the equal of his fellows means that he has the same right as each of the others to become unlike the others, to acquire a distinct personality, to contribute his one peculiar ray to the white light of the spiritual life" (p. 143); but we should like to know how to tell that one peculiar ray from others and how to identify the white light. It is true, the individual, encompassed on every side by uniform public opinion, "hardly ventures to hold his own judgment against the judgments of the majority"; and "the impulses of the mass tend also to threaten his independence of action." There is, however, no special merit or value in a judgment or action simply because it is a man's own or because it is different from that of others. We are not interested in having an infinite variety of judgments pronounced or acts performed, except in so far as they contribute to truth and goodness; and we need principles of selection to help us sift the true from the false and the good from the evil, to distinguish mere "otherwiseness" and freakishness in thought and conduct from uniqueness that has ethical worth. We need a criterion that will enable us to tell "the kind of difference which elicits correlated difference in all spiritual associates" from the kind that does not, and we need to know when such difference is correlated.

Professor Adler finds the chief defect in ethics up to the present time in the lack of a definite description of the spiritual nature, and endeavors to supply it: "The spiritual nature is the unique nature conceived as interrelated with an infinity of natures unique like itself. The spiritual nature in another is the fair quality distinctive of the other raised toward the Nth degree" (p. 231). This formula is not more definite than that of other idealistic moralists; the ideal of the *unique* self needs to be defined, no less than the ideal of the *true* self. But nearly all ethical thinkers endeavor to furnish a fuller description of the ideal life than is indicated in their formulas. Besides, the formulas are not so empty as they seem because the moral philosophers tacitly read into them the basal ethical values which the race

has won in its long experience: the spiritual life is a life of truth and justice and mercy; the true self is the self that sets its mind "on the things that are above, not on the things that are upon the earth." There is always more behind the formulas than in them, and they must be interpreted in the light of what is taken for granted. Professor Adler is no exception to the rule. We get a deeper insight into his real meaning as we go along, in the practical application of his philosophic theory, which comprises the larger portion of his book (pp. 147–372). And here we discover that the *unique* self does not differ much from the *true* self of his predecessors. Uniqueness finds its limitation in the universal; indeed, the only kind of uniqueness that is worthwhile is moral uniqueness. In his opposition to a levelling process that would blot out all originality and pound all men into a common pulp, and in his impatience with a civilization that turns out human beings like standardized factory-wares, *billig und schlecht*, to use Schopenhauer's phrase, Professor Adler overemphasizes the element of uniqueness. But it is, after all, always a moral uniqueness that he has in mind: "we can love only that which is lovable," the holiness and beauty concealed within our fellow-beings; "we must acquire the faculty of second sight, of seeing the lovable self as the true self" (p. 223). "The unique personality, which is the real life in me, I cannot gain, nor even approximate to, unless I search and go on searching for the spiritual *numen* in others" (p. 224). "For it is only face to face with the god enthroned in the innermost shrine of the other that the god hidden in me will consent to appear" (p. 225). Not every part of man is worthwhile. "Unless, then, there be some master end in everyone's life, one paramount to all others, to which all others are subordinate (the subordination and the renunciation being themselves means of spiritualizing one's nature) there is no point to the notion of service. That master end I have defined as the attainment of the conviction of one's infinite interrelatedness, the consciousness of oneself as a member of the spiritual universe . . . " (p. 228). "The spiritual society of which the image is to be imprinted on human society is a society of indefeasible ethical personalities" (p. 247). "I must have the courage and the truthfulness to look upon neighbor, friend, wife, husband, son, daughter *sub specie aeternitatis*, that is, as primarily spiritual beings" (p. 228). I must help them to realize the better part of their nature, to arouse in them the consciousness of the true self, the consciousness of the universal good, the consciousness of the ideal society of ethical personalities. This is the teaching of all idealistic ethics.

Professor Adler's unique individual is further limited as a member of the family, the school, the vocation, the state, the international society, and the ideal religious Society. "The sub-organisms are embraced within the superior organisms." But they are not swallowed up in them: "there are rights of the individual, rights of the family, rights of the vocational group, which the State does not create but is bound to acknowledge and which its power cannot properly infringe" (p. 306). Each sphere has its particular uniqueness, which must be respected. The importance of the vocations (among which motherhood will be recognized) is stressed: "the public good will be consummated when the conditions are furnished necessary and favorable to the development of personality in each of the constituent groups of the social body" (p. 314); indeed, the vocational group is made the basis of political representation. "Vocational representation, in my view of it, is the appropriate expression of the organic idea of the state. The state is the soul. The soul must have a body. Vocational representation is that body." The significance of this view can be fully understood only when we remember that Professor Adler conceives all the social institutions as "successive phases through which the individual shall advance towards the acquisition of an ethical personality" (p. 261). His ideal is the realization and preservation of distinctiveness in the individuals and in the groups, the state included. "The relative independence of the social sub-organism," he says, "is the salient point. This kind of independence is based on the general conception underlying my entire ethical philosophy, that the ethical quality resides in uniqueness in distinctiveness, that ethical progress consists in driving towards individualization in the sense of personalization. This is opposed to those philosophies of life that see the ethical quality in uniformity. Socialism is on the side of uniformity" (p. 274).

What I have been trying to show is that in spite of Professor Adler's occasional exaggeration of the element of uniqueness, he subjects it to limitations: to be ethical, uniqueness must submit to law. Not every kind of difference is moral. The worth of individual uniqueness is determined, among other things, by its fitness to make group-uniqueness possible; and the uniqueness of each sub-group, in turn, is judged by its effect upon that of the successive superior groups. The ethical individual wills to be a member of an organized spiritual world. He wills to be a social personality, which means to be a true individual. He wills the concrete universal. We cannot tear the notions of uniformity and diversity, sameness and difference, society

and the individual apart, as Professor Adler's own system abundantly proves. And if I understand the spirit of his philosophy aright, he conceives only that uniqueness as worthwhile, as worthy to be contained and continued in an eternal divine life, which is the expression of what is *best* in man, the will to realize the eternal, universal, values. This is the view of the ethical idealists from Plato to Bosanquet, of whom Professor Adler is the spiritual brother.

An Ethical Philosophy of Life is a noble contribution to the field of ethics, noble in substance and noble in its literary form. The practical part of the work, which does not follow the beaten track, is of unusual interest and value, particularly the chapters dealing with the Vocations, the State, and the National Character; the brief discussion of educational questions (pp. 291–304) is admirable in its thoughtfulness and suggestiveness. The conception of the university as a group of vocational schools may be accepted if we conceive the vocations ethically, as Professor Adler does, if we regard as its aim "to furnish leaders for all the various groups who will undertake the great business of truly organizing democracy," and if we include in this latter task leadership in research. The college Professor Adler looks upon as "a legacy which has come to us from a type of society unlike our own," as "an institution designed for the education of gentlemen," and he thinks it will disappear. We must admit that there is some ground for this pessimistic description, but does it not suggest the reform rather than the elimination of the college? There would seem to be a particular need of the college, as the basis for vocational instruction, in our author's ideal democratic society, but it would have to be something more than a mere pathway to materialistic success or a resort for the acquisition of a superficial culture.

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The Order of Nature: An Essay. By LAWRENCE J. HENDERSON. Cambridge, Harvard University Press; London, Oxford University Press, 1917.—pp. v, 234.

This book is a continuation and further development of a line of thought initiated by the author in a work published in 1913 under the suggestive title *The Fitness of the Environment.* The relation of the volume before us to the earlier book may perhaps be best indicated by quoting some sentences from the introductory chapter. "In a recent book," he writes, "I have tried to recall attention to the many interesting peculiarities of the environment and to state the facts concern-

ing the fitness of the inorganic world for life. . . . The primary constituents of the environment, water and carbonic acid, the very substances which are placed upon a planet's surface by the blind forces of cosmic evolution, serve with maximum efficiency to make stable, durable, and complex, both the living thing itself and the world around it. . . . Nothing else could replace them in such respects, for their utility depends upon a *coincidence* of many peculiar and unequaled properties which they alone possess. . . . In truth fitness of the environment is quite as constant a component of a particular case of biological fitness as is fitness of the organism, and fitness is quite as constantly manifest in all the properties of water and carbonic acid as in all the characteristics of living things. Such a conclusion, however, only touches the surface of the problem. . . . Just because life must exist in the universe, just because the living thing must be made of matter in space and actuated by energy in time, it is conditioned. In so far as this is a physical and chemical world, life must manifest itself through more or less complicated, more or less durable physico-chemical systems. Accordingly it is possible to assert and it will presently be demonstrated that the primary constituents of the environment are the fittest for those general characteristics of the organism which are imposed upon the organism by the general characteristics of the world itself; by the very nature of matter and energy, space and time. . . . The facts upon which this conclusion rests prove, I believe, that a hitherto unrecognized order exists among the properties of matter. Proceeding from the results of this earlier inquiry, I have, in the following pages, endeavored in a more rigorous manner to discuss the importance of the three elements [hydrogen, oxygen, and carbon] for the process of cosmic evolution and by eliminating all biological theories and principles to rest the conclusions exclusively upon the secure foundation of abstract physical science." But the author has also, as he says, "after much hesitation, ventured to sketch the development of thought upon the problem of teleology, and at length to confront the scientific conclusions with the results of philosophical thought, in order finally to attempt a reconciliation." But "the scientific conclusions are independent of the philosophical problem of teleology. . . . And "the present essay professes to demonstrate nothing but the existence of a new order among the properties of matter, and only to examine the teleological character of this order."

It would be difficult, even if I felt myself competent, to give a summary of the author's closely reasoned argument. I shall try to

indicate merely the character of his main results, and shall add a few comments of my own in regard to certain views which he has expressed.

What Professor Henderson has done is to call attention to the fact that not only the biological sciences, but chemistry and physics as well, recognize the existence of an order which is not mechanical but forms the 'organization' or 'system' or 'pattern' within *which mechanical causes have meaning or relevancy*. Such a view is teleological, not only in the sense that there is a complementary connection between the different elements which compose the 'system,' but also in the sense that the earlier stages of the evolutionary process through which the 'system' passes must be regarded as a preparation for the later. That the concept of 'organization' is operative as a working principle within the biological sciences is too evident to admit of any debate. But that the sciences of inorganic nature also base themselves on the assumption of order and individuality in the systems of phenomena with which they deal is not so immediately apparent, and is from the point of view of the physical sciences a comparatively new doctrine. Yet it follows directly from the position maintained by philosophy since the time of Aristotle that what is real is individual. It is of great importance, however, to have this stated from the scientific point of view and supported by arguments drawn from the procedure and theories of representatives of the physical sciences. One result of this argument is to show, as Professor Henderson says, that "the problem of the teleological form and behavior of the organism merges in the larger question of the order of nature" (p. 116).

But Professor Henderson does not confine himself merely to calling attention to the reality of the teleological appearance of the world as a whole. This is a fact that it is no longer permissible to doubt. The question, however, remains "how the production of this order is to be scientifically explained. What is the mechanistic origin of the present order of nature?" (p. 119). The complete answer to this problem would involve an exhaustive statement of all the details of the evolutionary process, something which is of course impossible. Nor is it possible, according to the author, to explain the evolution of the existing order of nature solely in terms of general laws. These laws do not serve to account for the diversity which things assume in the process of evolution. "The general laws of science do not sufficiently account for the evolution of the globe. The Phase Rule, the second law of thermodynamics, the principles of statistical mechanics and the fact of the stability of dynamic equilibrium are all, like the laws of con-

servation and of gravitation, conditions of the process. But the process itself is the evolution of the original matter and the original energy of the globe. It is the properties of this matter and of this energy which chiefly bring to pass the manifold events in the history of the earth, or at least which make it possible that they should be manifold" (pp. 144–145). The problem of the coöperation of the laws of nature still appears to the author a genuine problem, but he regards it as less promising than that regarding the properties of matter and energy (pp. 148–149). His own specific contribution to the explanation of the teleological appearance of the existing order of nature confines itself to an examination of the properties and activities of the three chemical elements, hydrogen, oxygen, and carbon, which seem to him the main causes which explain the evolution of the diversity and stability among the systems which constitute the order of nature. "How is it that, on account of the peculiarities of these three elements, there are so many degrees of freedom left open in the evolutionary process" (p. 154)? This is the question which was treated in the author's earlier work, and the analysis of which, as he says, he has here endeavored to simplify and generalize.

Without attempting to follow the suggestive and instructive analysis of this problem, I wish to call attention to one fact which the author emphasizes, viz., that the scientific explanation of the existing order of nature which he furnishes rests upon an original and permanent order of relations between the three elements. The present teleological order is explained scientifically by showing it as the result of an earlier order among the elements which is capable of definite expression, but it is not derived from any chance play of unrelated mechanical causes. "We may therefore conclude that there is here revealed an order or pattern in the properties of the elements. This order is, so to speak, hidden, when one considers the properties of matter abstractly and statically, for it is recognizable and intelligible *only* through its effects. It becomes evident only when time is taken into consideration. It has a dynamical significance, and relates to evolution" (pp. 184–185). "It cannot be that the nature of this relationship is, like organic adaptions, mechanically conditioned. For relationships are mechanically conditioned in a significant manner only when there is opportunity for modification through interaction. But here the things related are supposed to be changeless in time, or, in short, absolute properties of the universe. According to the theory of probabilities this connection between the properties of matter and the process of evolution cannot be due to mere contingency. There-

fore, since the physico-chemical functional relationship is not in question, there must be admitted a functional relationship of another kind, somewhat like that known in physiology. This functional relationship can only be described as teleological" (p. 211).

The form of argument leading up to these conclusions is at first sight different from that which speculative philosophy employs in its argument for the systematic and individual character of reality. But on reflection one sees that the methods are not diverse, but rather complementary applications of the same logical procedure of bringing to light the implicit assumptions in experience, of viewing it speculatively,—*i. e.*, seeing it in the completeness of its concrete detail and movement. The divergence in the order of facts to which appeal is made is more apparent than fundamental, and the two lines of argument are only different phrasings of the one philosophical interpretation. One cannot, I think, read a book like *The Order of Nature* without realizing that philosophy and science are not opposed, or even separable methods of inquiry, and that the distinctions between them after all are only provisional.

Though these conclusions are suggested by Professor Henderson's book, I am not sure that he would accept them. One finds cropping out here and there in his pages a strange hesitation in regard to philosophical results, and also the old assumption that mechanism affords a kind of intelligibility which is more complete than that of any other mode of explanation. It seems that he has not himself realized the transforming effect for natural science of the concepts which he has helped to establish. If the new concepts are recognized as legitimate, explanation in terms of mechanism can no longer be regarded as a complete and final answer even to the problems raised by the physical sciences. Mechanism is indeed not denied or abrogated, but as interpreted by this philosophy it becomes a means or instrument which contributes to the intelligibility of reality in terms of individual systems.

Scientists have frequently regarded it as a duty to lecture philosophers upon their predilection for *a priori* deductions and their neglect of facts. Doubtless these warnings have not been entirely unnecessary, and on the whole they have been accepted in good part by those to whom they were addressed. But are not they in their turn in need of the service of philosophy to warn them against the *a priori* domination of mechanistic conceptions and to help them appreciate other forms of intelligibility? It seems to me one of the most hopeful signs of the times that scientific thinkers are themselves now actively engaged in

applying the results of philosophical reflection in an attempt to recognize the more concrete categories which are demanded by the actual facts of experience. In this connection Professor Henderson's book is one of great philosophical importance, and by the fresh light which it throws on many questions will also be found enlightening by students of philosophy. No one can read it without feeling himself the author's debtor.

Just because of my great appreciation of the book, however, I feel that I should specify my reasons for thinking that Professor Henderson has not himself quite realized the significance of the new standpoint which his analysis has reached. It is especially from his remarks regarding the relation of mind and body, in the chapter entitled "Biology" that I draw this conclusion. Although he recognizes explicitly the validity of the concept of 'organization,' the discussion of the relation of mind and body seems still to be carried on upon the old Cartesian assumptions; we still have left the 'tormenting psycho-physical paradox' without any suggestion of a possible principle of solution, but with the hope expressed "that in time this difficulty will somehow be circumvented" (p. 99). Again, on page 97, as a comment on a quotation from Hobhouse: "Consciousness does indeed inform us that the organism is more than a physical structure; no doubt it is a psycho-physical whole. Accordingly some of its actions do not, strictly speaking, conform to mechanical laws. An instance of this is a choice or any other psychical activity. But even so, it involves a further assumption to assert that the *physical* activities of the organism even when parts of psychophysical activities can ever be explained as not in conformity with mechanical laws." The last sentence, which might be parallelled by others from this chapter, exhibits the author as still holding fast to dualism, and to the notion of the organism as having a psychical part *plus* a physical part, which latter, *as purely physical*, would seem to demand a mechanical explanation. The true notion of organism, as expressed by Hobhouse in the quotation on this page,—that of "a system whose mode of action as a whole departs from that of mechanism in virtue of its specific quality"—is not grasped and applied, and consequently the old antinomies of the dualistic position are left standing. Professor Henderson appears still to hold fast to Kant's dictum, that where the possibility of a mechanical explanation ceases there ceases also the ground of intelligibility of phenomena. Perhaps one may set this down as an 'idol of the cave,' arising from his professional preoccupation with physics and chemistry. It is interesting to contrast this postulate

with that of a thinker whose primary point of departure is furnished by the facts of the organic world. Dr. Haldane insists that biology, while recognizing the place and service of mechanism as an instrument, can make progress only by going beyond the physical and chemical conceptions of matter, energy, structure, cause, etc. It has been common to assume that it is only by employing mechanical conceptions that it is possible to deal scientifically with the facts of the material world—*i. e.*, to describe and explain their activities with exactness. Dr. Haldane, on the contrary, vigorously maintains that exclusive adherence to the mechanical dogma has on the contrary been a hindrance in dealing with the facts of biology. I quote a paragraph from his *Organism and Environment* (1917): "Anatomy and physiology, but more particularly anatomy, have become hidebound in the conception that living structure is simply physical structure; and in consequence of this anatomy has for the present the aspect of almost a dead science, in spite of the new life impulse from experimental embryology. The time has come for biology to liberate herself and step forth as a free and living experimental science, with a world before her to conquer by the help of clearer ideas of what life is, and how it can be investigated" (p. 103).

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NOTICES OF NEW BOOKS.

The Philosophy of Benedetto Croce. The Problem of Art and History. By H. WILDON CARR. London, Macmillan and Co. 1917.—pp. x, 214.

Signor Croce's principal philosophical writings have become known to English readers through the translations of Mr. Douglas Ainslee, several of which have been reviewed in this journal; but Professor Carr's monograph is, I think, the first English book to attempt to present in a systematic way the main outlines of Croce's philosophy as a whole. There can be no doubt that Croce has something significant to say, and is likely to attract more attention in the immediate future than he has yet received from philosophical scholars. Whatever the final verdict of philosophy may be regarding the originality and importance of his ideas, we may count it a real gain to make the acquaintance of a writer who combines such power and freshness of imagination with learning and logical power. One is fortunate, too, in being guided by such an admirable expositor as Professor Carr, whose earlier book, *The Philosophy of Change*, has proved of the greatest possible service in promoting a sane and scholarly interpretation of Bergson's philosophy, often indeed succeeding in clearing up difficulties which that author has left untouched. In the present work he has confined himself more closely to explaining and illustrating his author's ideas, without attempting to the same extent as in the Bergson volume a discussion of fundamental principles. Professor Carr has not based his study of Croce upon the English translations, but has referred to the original Italian, and furnished his own translations of the passages quoted. The result seems to me in the highest degree satisfactory. I can scarcely imagine how it would be possible within the compass to give a clearer and more coherent account of Croce's views. One feels that the author has presented the ideas of the Italian philosopher sympathetically and with understanding, yet with no attempt to conceal the omissions and lack of completeness that his system exhibits. Indeed, he stops from time to time to point out the circumstances which have determined the direction and emphasis of Croce's philosophy, adding at one point the following interesting remark: "Every philosopher comes to philosophy with some predominating interest—it may be the problem of religion, the problem of biology, the problem of physical reality, the problem of good and evil, but according to his interest the direction and form of his speculation is determined" (p. 30).

This is not the place to attempt a summary of Croce's main ideas, or to discuss the principles of his philosophy. Professor Carr in a recent article published in the *Proceedings of the British Academy* (Vol. VIII) gives the following statement of what he calls "its main burden": "the fundamental notion on which it is based is that the human mind is subject to a persistent

illusion which pursues it into every sphere of its activity, the notion of existence as something alien, confronting the active mind, independent of it, to which the value mind creates is something added." On the basis of this account those who feel uneasy until a philosophical writer is duly classified may fearlessly attach the label 'Anti-Realist' or 'Idealist' to Croce's philosophy. He is probably more influenced by Hegel than by any other of the classical line of philosophers, though in certain fundamental points he is fond of showing the identity of his doctrine with that of Kant. The philosopher, however, whom Croce honors above all others, is Giambattista Vico. To him, as Professor Carr tells us, Croce awards the distinction of having anticipated the philosophical movement associated with the names of Kant and Hegel (p. 93).

Notwithstanding these general affiliations, Croce's philosophy has an individuality of its own, while his rejection of all transcendent problems and insistence on the fundamental identity of philosophy and history bring his thought into close relation to certain important tendencies of the present day.

J. E. CREIGHTON.

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Idea and Essence in the Philosophies of Hobbes and Spinoza. By ALBERT G. A. BALZ. Archives of Philosophy. Edited by Frederick J. E. Woodbridge. New York, Columbia University Press, 1918.—pp. 86.

"The purpose of the essay," the writer states, "is to portray the gross misconstructions that have been placed upon the work of Hobbes and Spinoza by taking as the basis of investigation the psychological standpoint of a later day" (p. 78). "The thesis advanced has a negative and a positive aspect. The negative side consists in a denial that either philosopher was actuated by the conception of existence as dual, or that the notion of the 'psychical' or 'spiritual' played an influential rôle in their speculations. . . . The positive side of the thesis may be rendered as follows: First, it is maintained that Hobbes and Spinoza conceived of existence as one, and that this order of existence is, as we should say, the 'physical.' . . . Secondly, with reference to psychological doctrine, it is asserted that with both investigators psychology is purely physiological in character" (p. 7). Seventeen pages are devoted to Hobbes; fifty to Spinoza. The author declares that Descartes partially developed a theory of two mutually exclusive substances, extension and thought, and that in his treatment of thought he made the beginnings of, or at least prepared the way for, a science of states of consciousness. But neither Hobbes nor Spinoza, according to the author, followed the leadership of Descartes in this cleavage of existence. For Hobbes, psychology was a branch of physics, and all psychological facts were motions or clashes of motions (p. 13). The subject of sense was not soul nor mind, but some living creature (p. 12). Seth's interpretation of Hobbes's 'phantasm' as a state of consciousness (*English Philosophers and Schools of Philosophy*) is not, the author thinks, supported by a careful study of the text; the 'phantasm' is as much a set of motions as the

extra-organic object. The study of Spinoza is much more elaborate than that of Hobbes, but its movement and conclusion are analogous. "The claim is advanced that Spinoza's psychology is thoroughly like that of Hobbes, at least in its first intention. It is, on the whole, as radically 'physiological' as that of Hobbes. . . . His psychological terminology is free from implications possessed by that of Descartes. Neither his philosophy nor his psychology is rooted in a doctrine of existence as dual" (p. 29).

Most students of the history of philosophy would agree with the author's positive interpretation of the two systems in question: Hobbes conceived of the world as a vast mechanical order; Spinoza's ideal was fundamentally logical and ethical. But the reader gets a disturbing sense of an effort to make these philosophers of the seventeenth century more logically precise and self-consistent than he can believe them to be. Everyone knows that it used to be the fashion to accept Spinozism as a simple logical unit, and to suppose that the matter of the system was as coherent as the form would suggest. But, more recently, thoughtful commentators have been unable to state that system in terms of a single method; indeed, they have been forced to leave parts of it standing in irreconcilable contradiction: for example, H. H. Joachim, *A Study of the Ethics of Spinoza*, pp. 104, 137. Such a painstaking study as that by Professor Ernest Albee on "The Confusion of Categories in the Philosophy of Spinoza" (*Studies in Honor of James Edwin Creighton*) leaves little doubt that Spinoza shifted in his conception of the type of parallelism that relates ideas and things.

From the "Conclusion" it is evident that the author's interpretation of Hobbes and Spinoza is simply an application of a general theory of the nature and limits of historical study in philosophy. While this very essay is proof of his belief in historical research, he would definitely 'teach it its place.' He speaks of "that mistrust of previous speculation which is a healthy manifestation of the philosophy of the day." He seems unconsciously to look at historical study from without and to apply to its methods and problems some absolute standard which he calls "what the problem is" (p. 79). Apparently for him a philosophical problem may be injected into this or that period of history without being internally affected: "If the historical problem is genuine, human experience at any age will generate it" (p. 79). But philosophical problems cannot properly be classified into the "genuine" and the "artificial"; they cannot be treated as '*things*,' the setting of which is relatively indifferent. The history of philosophy is a *life*, which is continually turning upon itself in criticism; and such criticism rests not upon something outside of the process but upon the total achieved development. The author's own work seems at times to reflect the inadequacy of his theory. For example, why should one who was sure of his history of philosophy refer to Toennies in support of the commonplace that the "epistemological question of the time was whether knowledge attaining the level of the certainty of mathematics, of geometrical demonstration from axioms and definitions, was possible, and how it was possible" (p. 9)? Again, the author seems to infer that the whole connection

between Descartes and Spinoza has been over-estimated because their psychology has less in common than is usually supposed. The author's treatment shows in general a failure to do explicit justice to the complexity of the development of early rationalism.

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Seneca ad Lucilium Epistulae Morales. With an English Translation by RICHARD M. GUMMERE. London, William Heinemann (The Loeb Classical Library.) New York, G. P. Putnam's Sons, 1917.—pp. xvi, 467.

The editors of the Library have done well to include in it the *Epistles* of Seneca, which have not been easily accessible to English readers. The translation by Lodge was last issued in 1632, and that by Morell in 1786, and there have been no other complete translations. Lodge's rendering is so excellent that one is inclined to wonder why Professor Gummere did not select it as the basis of his edition, as the editor of Apuleius in the Loeb Library chose that of Adlington. Morell's translation is also of value, being sometimes superior to that of Lodge. Lodge's principle of translation was to render the thought rather than the word, and he has succeeded in making 'this admirable Roman speak English,' as he puts it in his Address to the Courteous Reader. It is true that at times he paraphrases, but his translation is not as a whole unduly free; sometimes it follows the original more closely than that of Professor Gummere. Yet it gives the impression, in general, of a work composed in English, while the new rendering is often an obvious translation. Lodge grasps Seneca's thought in larger sections than Professor Gummere, who seems to work sentence by sentence. This effect is perhaps partly the result of a praiseworthy attempt to reproduce the style of Seneca, but I do not feel that he is more successful than Lodge in this. The earlier writer is also more felicitous in his choice of individual words. As an example of some of these things, Professor Gummere writes: "But I must end my letter. Let me share with you the saying which pleased me to-day. It, too, is culled from another man's Garden." (p. 19). Lodge has it: "I will here make an end of my letter, in making thee partaker of the fruit which this day I have gathered in another man's garden." There are a few places where the recent rendering is unnecessarily colloquial or that of the present day, for example in writing, the "letter . . . you had posted," for 'epistulam . . . miseras' (p. 331).

I have observed a few inaccuracies. For instance, the sentence, "*Eodem die ubi luserunt navigia, sorbentur,*" is rendered, "The very day the ships have made a brave show in the games, they are engulfed." '*Ubi*' indicates that the meaning is not only "on the same day' but 'in the same place'; at least, the word should be rendered. Lodge translates: "Those ships are swallowed the same day, where they wantonly played on the water." In the note on page 436, perhaps by a misprint, Serenus is said to have died from eating "poisoned," instead of poisonous, mushrooms.

However, the translation on the whole renders Seneca's thoughts clearly

and with spirit. It can be read with pleasure, and is to be recommended to those who have gained profit from other Stoic writers, such as Marcus Aurelius, but who, because a translation was lacking, have been unable to study Seneca's *Epistles* in their attempts to learn—as Lodge puts it—"how to live and how to die well."

ALLAN H. GILBERT.

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The Theory of Environment: Part I, An Outline of the History of the Idea of Milieu, and its Present Status. By ARMIN HAJMAN KOLLER. Menasha, Wisconsin, 1918.—pp. x, 104.

This book deals with the influence on man of geographical and climatic environment. The author says in the Preface: "My present concern in this theory being genetic and historical, it seemed best to assemble all the sources one could find bearing on the history of the theory and to indicate the trend of its development in a rough preliminary sketch."

It seems as though this work, with two-hundred and ninety-four footnotes on ninety-four small pages of large type, might have been made frankly a chronological bibliography of the important works on the subject, with comment, and an introduction, for that is what it essentially is. Even the text is made up mainly of quotations, often not from the work the author is discussing, but from some book about it. The author even needlessly quotes incorrect statements, calling attention to their errors. He ventures to say something himself, it seems, only when he knows of nothing that has been written about the book he is treating. The use of so many footnotes, numbers of which could have been omitted or combined with others, and the dependence on quotation do not represent the best scholarly method. This second-hand procedure is like that of the Scribes, who did not teach as though "having authority." One gains—wrongly, I trust—the impression that Dr. Koller has not studied for himself some of the authors, especially the earlier ones, with whom his quotations deal. The section on Jean Bodin (pp. 14–21), for example, is valuable or not according to the worth of what is apparently a dissertation by a pupil of Lamprecht's, on which the author depends. We must all use the critical writings of our predecessors, yet if we do not read a book independently, we cannot assure either ourselves or others of its historical importance; it is one of the diseases of scholarship that, when we might read the great books themselves, we read and accept current interpretations of them. An advanced student should use an exposition of any work of importance to him not as a substitute for it, but as a key to it. It is strange that Dr. Koller, so precise in similar matters, allows himself to quote at second hand. For instance, he does not quote from the original of the *Nouvelle Géographie Universelle*, but relies on a German translation of extracts included in another work. He does not claim completeness for his study, yet he need not have neglected the greater Latin authors. Cicero (*De Fato* 7) ,for example, echoes Plato (*Timaeus* 24) in speaking of the effect of the climate of Attica in

producing wise men, and Lucretius (*De Rerum Natura* 6.1103–18) mentions the effect on mankind of various climates. In connection with Bodin the author might have said something of the Italian economist Giovanni Botero, and perhaps of the German cosmographer Sebastian Münster. Since Shakespeare is included, Milton should also appear, for he suggested that "cold climate" might prevent him from rising high in poetry (*Paradise Lost* 9.44–6), and in his tractate *Of Education* he mentions the supposed effect of northern air on language. The author does not handle his subject philosophically or critically: he does not, for instance, remark on the advantages and disadvantages of the statistical method used by the brilliant Ellsworth Huntington in the work summarized at rather disproportionate length on pp. 97–103. Dr. Koller's English style is also not beyond improvement.

But though the book cannot be given high rank as a historical treatise, it is useful, for it does something toward satisfying our real need for a history of geographical theory—a subject which has not yet been adequately treated. In judging Dr. Koller's production we should remember that he did not have a beaten track to follow. We cannot but welcome it as a bibliography such as is not elsewhere to be found. The references to work done during the past century, both on the history of the subject and in its further exposition, seem very full. Such valuable assistance in our study of the inclusive and important subject of man's relation to his physical surroundings is gladly to be received. The work also deserves praise for indicating that this relation was observed in antiquity, though it has received systematic attention only in recent times. We should commend the author because he undertook this historical and scientific study as a student of literature, for it is the result of his desire to understand Herder's theory of milieu. Such a study is by nature altogether above the ordinary loose talk about a poet's theory of nature, and suggests a method of finding out what a poet's theory really is. A student of literature who engages in such labors reveals a true appreciation of the complex nature of literature in its infinite connections with the thought and life of men, and is evidently aware that its adequate interpretation requires wide and deep knowledge.

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The following books also have been received:

Proceedings of the Aristotelian Society. New Series.—Vol. XVII. Containing the papers read before the Society during the Thirty-eighth Session, 1916–1917. London, Williams and Norgate, 1917.—pp. 497.

Studies in the History of Ideas. Edited by the Department of Philosophy of Columbia University. Vol. I. New York, Columbia University Press, 1918.—pp. 272.

Social Process. By CHARLES HORTON COOLEY. New York, Charles Scribner's Sons, 1918.—pp. vi, 430.

Studies in the History and Method of Science. Edited by CHARLES SINGER. Oxford, at the Clarendon Press, 1917.—pp. xiv, 304.

NOTES.

Basis of Reference in Discussion on Mechanism and Vitalism.

We reprint here from *The Journal of Philosophy, Psychology and Scientific Methods* (Vol. XV, No. 17) "The Basis of Reference" adopted by the Leaders of the Discussion to be held before the American Philosophical Association at its meeting, December 27 and 28, 1918:

"What follows attempts to be an objective statement of the present condition of science, bearing on the problem of Mechanism and Vitalism:

"1. A geometrical description of the universe has been found applicable, without measurable imperfection, to all parts of the universe in so far as they occupy space. All material objects, all living bodies, are geometrical.

"2. A kinematical description of the universe also has been found applicable, without measurable imperfection, to all parts of the universe which occupy space. This description involves time and motion as well as space. All material objects, all living bodies, are kinematic.

"3. A mechanical description, involving the further concept of mass, also has been found applicable, without measurable imperfection, at least to all large masses. All large material objects, all large living bodies, are mechanical.

"4. A physico-chemical description, involving such concepts as chemical composition, differentiation into phases, concentration, and every kind of potential, also has been found applicable, without measurable imperfection, in the preliminary survey of all molecular systems. All living bodies are molecular systems, or, in other words, are physico-chemical.

"5. A description in geometrical, kinematical, mechanical, and physico-chemical terms may be called a *mechanistic* description.

"6. The evidence in favor of the complete validity of the mechanistic description consists in its continuous development without any check, and in the fact that all quantitative measurements are consistent with such a description.

"7. The discrimination of living bodies from other physico-chemical systems rests upon certain common characteristics of the former class of systems. These characteristics are probably best described by the words organization and regulation.[1] It is true, however, that regulation, and perhaps also organization, can occur elsewhere. Living organisms may also be characterized by assigning the words function and teleology to their behavior or their constitution. They are, nevertheless, mechanistic through and through because they are physico-chemical systems, manifesting mechanical phenomena, kinematical phenomena, and geometrical characteristics.

"8. The ascending scale from geometry to physical chemistry and on through

[1] The addition of growth, reproduction, nutrition was suggested by one member.

the organic to what Spencer calls the super-organic is not to be regarded as a classification which has been worked out with complete success. Nevertheless, the several sciences involved include all the known kinds of natural phenomena, at least below the level of the organic, and perhaps below the level of mind. Moreover, the whole experience of science shows that these several departments of science are strictly additive and cumulative. The kinematical is the geometrical plus something else. The mechanical is the kinematical plus something else, and so on. There is much room for difference of opinion whether these successive increments are homogeneous or heterogeneous. But this is probably a matter of definition or of scale. What is important is the vast induction that they involve only addition."

We give below a list of articles in current philosophical magazines:

MIND, XXVII, 107: *H. Rashdall*, The Religious Philosophy of Professor Pringle-Pattison; *C. D. Broad*, A General Notation for the Logic of Relations; *J. E. Turner*, Dr. Bosanquet's Theory of Mental States, Judgment, and Reality; *W. M. Thorburn*, The Rights and Wrongs of a Person (I).

THE AMERICAN JOURNAL OF THEOLOGY, XXII, 3: *Andrew Edward Harvey*, Martin Luther in the Estimate of Modern Historians; *M. Sprengling*, The Aramaic Papyri of Elephantine in English (Continued); *A. Clinton Watson*, The Primary Problem for an Empirical Theology. II; *James Westfall Thompson*, Church and State in Mediaeval Germany. III; *Elmer Truesdell Merrill*, On "Clement of Rome."

THE MONIST, XXVIII, 3: *William Benjamin Smith*, Mors Mortis; *James H. Hyslop*, Predicaments in Philosophy; *Eugenio Rignano*, The School of To-Morrow; *Victor Delbos*, The Conceptions of the History of Philosophy; *Edward Lawrence*, Prayer. Its Origin, Meaning and Ethical Significance; *James Lindsay*, Rationalism and Voluntarism.

PSYCHOLOGICAL REVIEW, XXV, 4: *H. B. Reed*, Associative Aids: II. Their Relation to Practice and the Transfer of Training; *Rudolf Pintner*, Intelligence as Estimated from Photographs; *Curt Rosenow*, The Genesis of the Image; *Leonard T. Troland*, The Heterochromatic Differential Threshold for Brightness: I. Experimental; *Prentice Reeves*, The Rate of Pupillary Dilation and Contraction.

THE JOURNAL OF PHILOSOPHY, PSYCHOLOGY, AND SCIENTIFIC METHODS, XV, 15: *Wilbur M. Urban*, Again, the Value Objective and the Value Judgment: Reply to Professor Perry and Dr. Fisher; *Louise Brink*, How the Concept of the Unconscious is Serviceable; *Wendell T. Bush*, Another Comment on Professor Warren's Analysis of Purpose.

XV, 16: *George Santayana*, Literal and Symbolic Knowledge.

XV, 17: *B. H. Bode*, Consciousness as Behavior; *Henry Bradford Smith*, Non-Aristotelian Logic.

XV, 18: *Hartley B. Alexander*, Metaphysics as a Fine Art; *M. T. McClure*, Pragmatism and Democracy; *Wesley Raymond Wells*, On Religious Values: A Rejoinder.

XV, 19: *F. C. S. Schiller*, Truth and Survival Value; *David F. Swenson*, Sixteen Logical Aphorisms.

XV, 20: *Grace A. deLaguna*, The Empirical Correlation of Mental and Bodily Phenomena; *Rupert Clendon Lodge*, The Division of Judgments.

REVUE PHILOSOPHIQUE, XXIII, 7 and 8: *G. Seailles*, Jules Lachelier. La méthode de réflexion; *J. Sageret*, L'opinion; *A. Rey*, La transmutation et les sciences physico-chimiques; *A. Chiappelli*, Le concept moderne de la philosophie; *L. Dugas*, Habitude et conscience.

XXIII, 9 and 10: *L. Robin*, Études sur la signification et la place de la Physique dans la Philosophie de Platon (Ier article); *G. Milhaud*, Descartes expérimentateur; *H. Piéron*, La mémoire; *G. Belot*, L'avenir de la Religion et le mysticisme moral d'après M. Loisy.

REVUE DE MÉTAPHYSIQUE ET DE MORALE, XXV, 3: *M. de Wulf*, Civilisation et philosophie aux XIIe et XIIIe Siècles; *E. Guillaume*, La théroie de la relativité et le temps universel; *V. Delbos*, L'Art et la Philosophie.

RIVISTA DI FILOSOFIA NEO-SCOLASTICA, X, 3: *Federico Kiesow*, Il processo di Socrate; *Maurice De Wulf*, L'ordine artistico.

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